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Vol. XXII MARCH, 1917 No. 3

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COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Vol. xxii. MARCH, 1917 No. 3

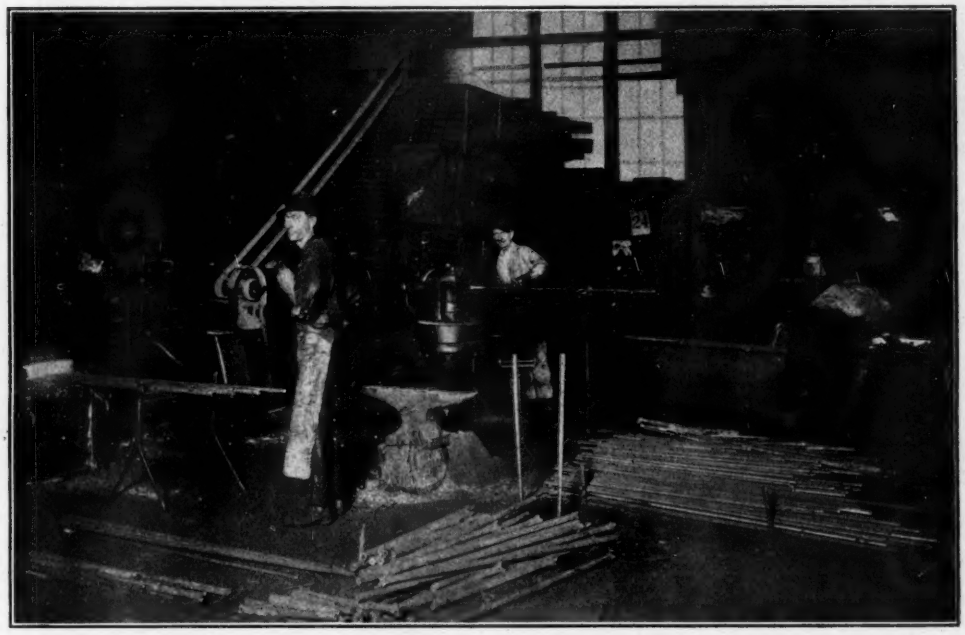


FIG. 1. DRILL SHARPENING SHOP AT UNITED VERDE MINE.

DRILL SHARPENING SYSTEM AT UNITED VERDE MINE

BY FRANK RICHARDS*

The ground in the United Verde mine is hard, and as a result the steel is quite dull when it reaches the sharpening plant. This is especially true of the steel used in conjunction with the Leyner drills. The sharpeners are in continuous operation during the entire 8-hr. period. A highly efficient system of collecting, sorting and routing, sharpening and distributing has been developed at this mine.

Dull steels are collected on the various levels underground, brought to the surface and sorted by nippers onto steel cars. These cars consist of trucks on which are mounted four-section bodies, revolving on ball bearings (Fig. 1). By sorting at this point, the blacksmith is saved several miles of walking each day.

The sharpening plant is located aboveground and has three units, each consisting of an oil furnace. Davies air-operated punching ma-

Prize article in Engineering News.

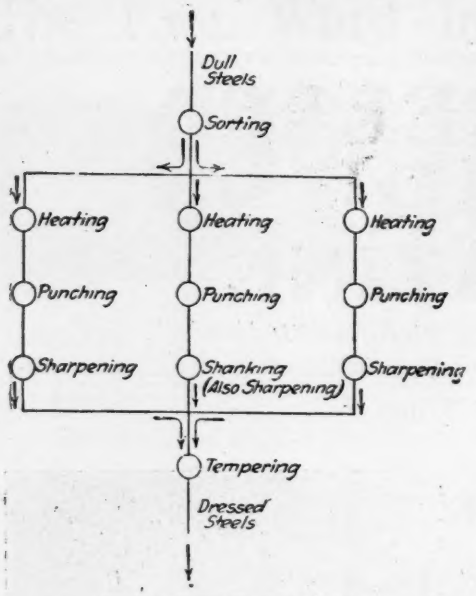


FIG. 2. ROUTE OF STEELS.

chine, Leyner drill sharpener and Davies blow gun.

The steel travels from the dull-steel car in approximately a straight line through each unit to a car for the sharpened steel (Fig. 3). The sequence of operations is as follows: The helper unloads the dull-steel car and places the steel in the furnace; when it comes to the proper heat, he removes it with his right hand, places it in the punching machine, while at the same time his left hand operates a clamping lever, then moves a few inches to the level that controls the punch—the entire operation is completed in 2 to 3 sec. The hole in the steel is opened for 3 to 4 in. The helper passes the steel to the blacksmith, who receives it in his left hand, places it in the sharpener, bringing the machine into operation with his right hand. After the bit is formed, the steel is reversed and the shank end is placed against the blower; this movement is really a step in transferring from the sharpener to the car. It is desirable to stand the steel with the bit up.

This method is identical for each sharpening unit, the sharp-steel cars from all traveling to one tempering forge. The steels are then brought to a tempering heat and delivered to the slack tub. Plunge tempering is employed, the bits in water and the shanks in oil.

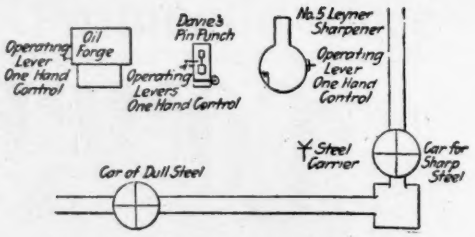


FIG. 4. LAYOUT OF A SHARPENING UNIT.

Between the sharpener and the temperer the steel cools to normal temperature and is ready for reheating. The utility man takes care of grinding and dressing the shanks, the No. 3 sharpener being the only one devoted to shanking. Figs. 2 and 4 show the layout of a sharpening unit. The forge is long and low, heating from 15 to 25 steels at one time. The helper starts the steel in the left-hand side of the forge, gradually working it to the right, each steel thus receiving the proper heat and also bringing it into easy removing position.

The punching machine (Fig. 5) consists of an air plunger governed by an oil cylinder. The piston rod carries a chuck for holding the punches. A self-centering clamp operated by an air cylinder insures alignment of steel and punch. This punch has increased the sharpening capacity 50%.

Each steel is tested by a blow gun. The blacksmith, while turning the steel up to place it on the car, pushes the shank against the automatic blow gun. This could be done without reversing the steel, but sparks were sometimes blown upon the operator; and as "Safety First" is one of the mottoes of this shop, the blacksmiths are instructed to test the steel from the shank end. Steel is punched, sharpened and blown out in one heat.

Supervision of drill shanks has resulted in

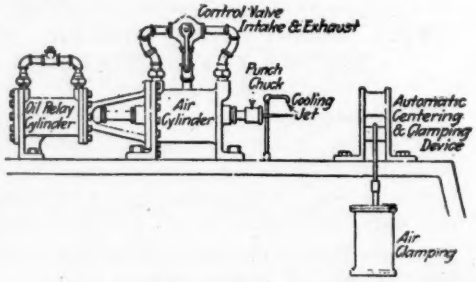


FIG. 5. PUNCH FOR HOLLOW STEELS.

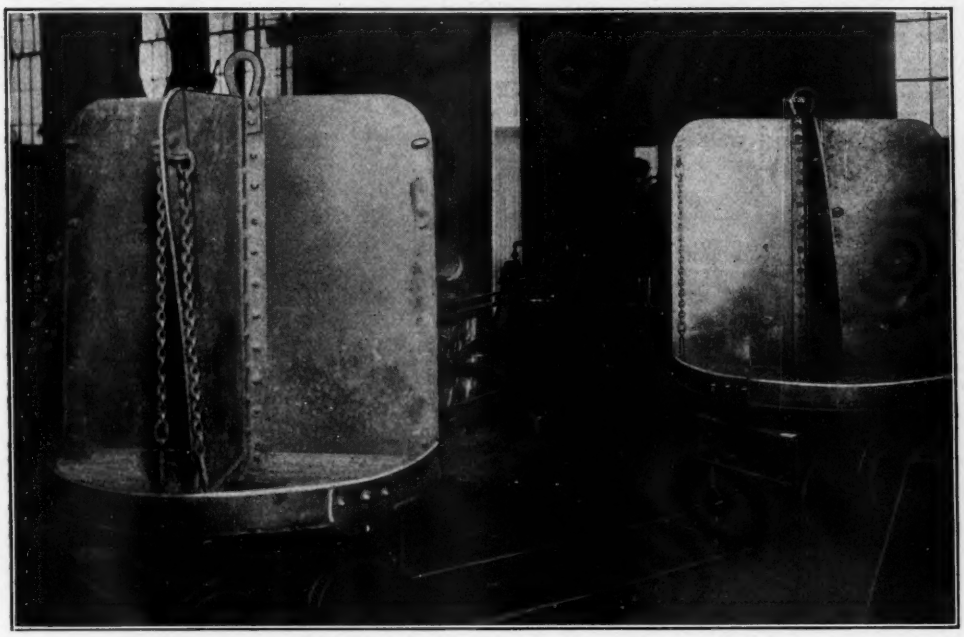


FIG. 3. CARS FOR STEELS, UNITED VERDE MINE.

reducing piston and drill-steel breakage. Out of about 5,000 pieces used, only two to three are broken per shift.

This paper embodies data furnished by Tom Davies, foreman blacksmith, United Verde Co.

Average number of steels sharpened per day	1,800
Type of bits	Crossbits
Length of steels	2 to 10 ft.
Shanks	60% Leyner-Ingersoll drill shanks with lugs, 20% "Jackhamer" shanks with collar, 20% Stopehamer shanks without collar
Grade of steel	0.75 to 0.95% carbon
Sharpening-plant equipment	Two No. 5 Leyner sharpeners and one No. 3 Leyner sharpener, each equipped with Davies hole-blowing device; three Davies punching machines; three oil furnaces and one tempering furnace
Shop blacksmith force	Three operators sharpening, three helpers heating and punching, one blacksmith tempering, and one utility man
Working shift	One 8-hr. shift per day

RUBBER SPONGE

Rubber sponges have been in use for quite a number of years, but until recently no one has attempted to utilize their rather peculiar properties in any other way than as a substitute for the natural sponge. Among the many methods of preparation, the time-honored practice has been to mix with the batch some material such as ammonium carbonate, which at the temperature of vulcanization gives off a considerable volume of gas, and thus causes porosity.

Because of its cellular structure, rubber sponge has several very peculiar properties; for example, it has the lowest apparent specific gravity of all solid bodies, its value being about 0.05. In spite of its cellular structure it is water-tight and very nearly gas-tight. While it is honeycombed with minute cells,

each cell is an individual unit and the rate of diffusion of gases through it is comparatively low. Perhaps one of the most important uses to which it has been applied is in the preparation of life-preservers. It will not water-log, is light, conforms easily to the lines of the body, and is not ruined by a pin-prick. A life-raft made with rubber sponge is as nearly proof against careless handling as one can be. All sorts of floating devices, such as buoys, markers, etc., may be improved by its use. A promising application is as a tire filler for automobiles. The most satisfactory tire filler available to date is air. It is now proposed to use rubber sponge molded to fit the inside of the tire casing, and in this manner produce a puncture-proof tire. The car still rides on air, but the air is confined in innumerable little sacs.

Hard rubber sponge is also available. It is prepared from soft rubber sponge by further vulcanization, and has many applications as heat insulating material, and, where lightness is desirable, to many minor structural parts. It has in fact considerable strength, and has been proposed as a material for the framework of aeroplanes. It has also been recommended as a material for constructing automobile bodies.—*Metallurgical and Chemical Engineering.*

COMPRESSED AIR FOR RAILROAD TRACK WORK

Mr. D. P. Falconer, Engineer of Maintenance of May New York State Railways, Rochester, N. Y., has the following to say in a recent issue of Electric Railway Journal:

It is a generally admitted fact that human horsepower is the most expensive kind of power which can be purchased, and it is for this reason that any equipment or machine which will transform electric or other energy into useful work in track construction or maintenance is economical. It is with this idea in mind that this company has endeavored to equip its track gangs with such labor-saving devices as are obtainable and suitable for its use.

One of these tools is the pneumatic tie-tamping outfit which we have had in use for the past two years. We have operated this machine with a gang of five men, one operator, two ballast distributors and two tampers. The ballast distributors and tampers alternate, and in this way avoid any excessive jar or possible fatigue due to the continued use of the tamping tools. The operator is the only man in the gang who is paid more than the regular laborers' rate and we have used common labor entirely for tamping track.

We find we can tamp from seventy to ninety ties per day which, assuming twenty days to the month and six months to a year as a working season, gives us about 4 1-2 miles of track tamped. This, of course, means new track or track which has been entirely reconstructed.

We have not obtained this record, however, with the use of our tamping outfit because we have used this outfit also for installing our riveted joints. A number of other uses for compressed air have been noted in the columns of this paper and undoubtedly this method of transforming energy will find a wide variety of uses in track construction and maintenance.

THE AIR BRUSH FOR METAL PRESS LUBRICATION

The lubrication of the surfaces of sheet metal in punching and drawing presses is more or less imperative and various arrangements are employed for the purpose, the swab or the dope kettle being the most common. In a certain shop where these devices were so evidently wasteful and otherwise most unsatisfactory a hint was finally taken from the paint shop of the same establishment. An air line was run through the shop to the various stands where the material was placed for the press feeders, and a short section of armored air hose attached to each line.

Air brushes were procured, one large one being bought first as a sample. This was found to give accurate placing of lubricant on any shape of blank sheet, and at the same time to keep the wastage down to a minimum, as the stream could be localized to within a close margin of the space actually affected by the pressing operation. The first brush was found too heavy for service if used constantly and smaller sets were obtained for regular use. These served the purpose admirably, and enabled the use of a better grade of lubricant for the same expenditure as was formerly used in covering wastage. The better grade meant longer die service, and consequent lessened die cost per hundred.

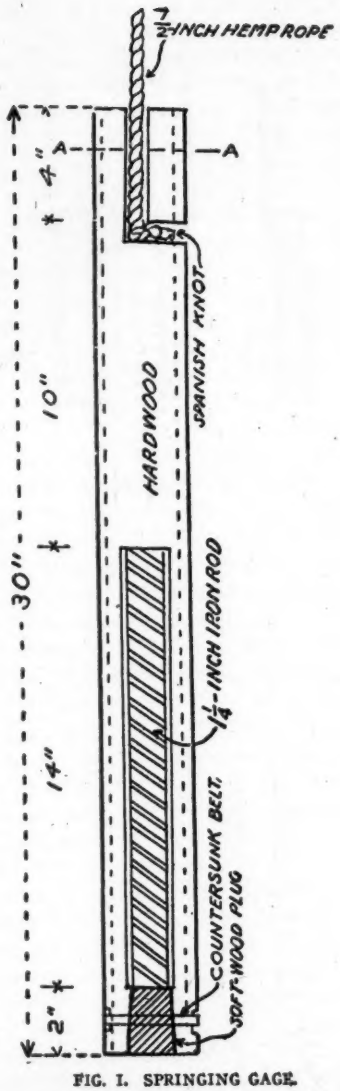


FIG. 1. SPRINGING GAGE.

THE "SPRINGING" OF BLAST HOLES IN ROCK

Bulletin 107, one of the latest of the valuable issues of the Bureau of Mines, is entitled "Prospecting and Mining of Copper Ore at Santa Rita, New Mexico," by Donald F. MacDonald and Charles Enzian. It comprises 122 pages of text with many full page half-tones not numbered, and many cuts and tables. It not only describes the actual mining operations in full detail but also deals with the supervising, directing and recording of operations. We reproduce here without further preface one detail of the work, necessarily more or less condensed, which should be of interest to many of our readers.

SPRINGING OR CHAMBERING HOLES

Before the drill holes are loaded and blasted, one or more small charges are exploded in the bottom of each, to make an enlarged chamber for the final charge. This is known as "springing" or chambering the holes. The aim is to make so large a chamber at the bottom of the hole that the charge may be concentrated into so compact a mass that none of it will fail to detonate, and that the explosive energy may be concentrated where it will give the maximum effect. The springing eliminates any water that may be in the hole, but it generally increases the liability of an inflow of water by shattering and fissuring the surrounding rock. If granulated powder can be forced into these fissured places the effectiveness of the blast is greatly increased.

Where the rock to be broken is relatively soft and weak, and the drill holes not more than, say, 30 feet deep and not over a third of that distance back from the face of a steam-shovel cut, one "springing" is usually all that is necessary. Where the rock is hard and tough, or where the holes are very deep, as many as four successive springing charges may be required before a chamber large enough for the final blasting charge is made. After each successive "springing" the hole

FIG. 2. USE OF SPRINGING GAGE.

must be cooled off, generally with water, before another charge is introduced.

PLUMMET FOR SOUNDING.

Both before and after springing the drill holes are sounded by a specially constructed plummet, a billet of hard wood about 30 inches long and having a metal weight in the lower end. This sounding apparatus, known as a "springing gage," Fig. 1, is attached to a rope and lowered into the hole. By tilting it from side to side while the lower end rests on the bottom, Fig. 2, the experienced chargeman can estimate the size of the hole. With this gage he also measures the depth of water in the hole. A small hand mirror is at times very useful for reflecting light into the hole, thus enabling inspection of the upper 10 to 30 feet.

The procedure in springing holes is somewhat as follows: The chargeman lowers the springing gage into the hole and notes its size and depth, the depth of water, etc. He then drops in the springing charge and again lowers the gage to determine whether the charge has reached the bottom. A fuse, passed diagonally through a stick of dynamite about 2 inches from one end, extends along the side of the stick to the other end, into which the end containing the detonator is inserted about 2½ inches, Fig. 3, A. This stick of dynamite, with cap and fuse attached, is called a primer. The fuse is then lighted and the primer is dropped or lowered into the charged hole, followed by a hurried lowering of the gage to show whether the primer has reached the bot-

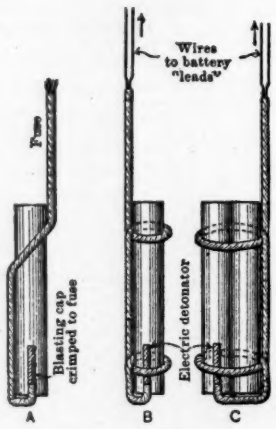


FIG. 3. FUSES.

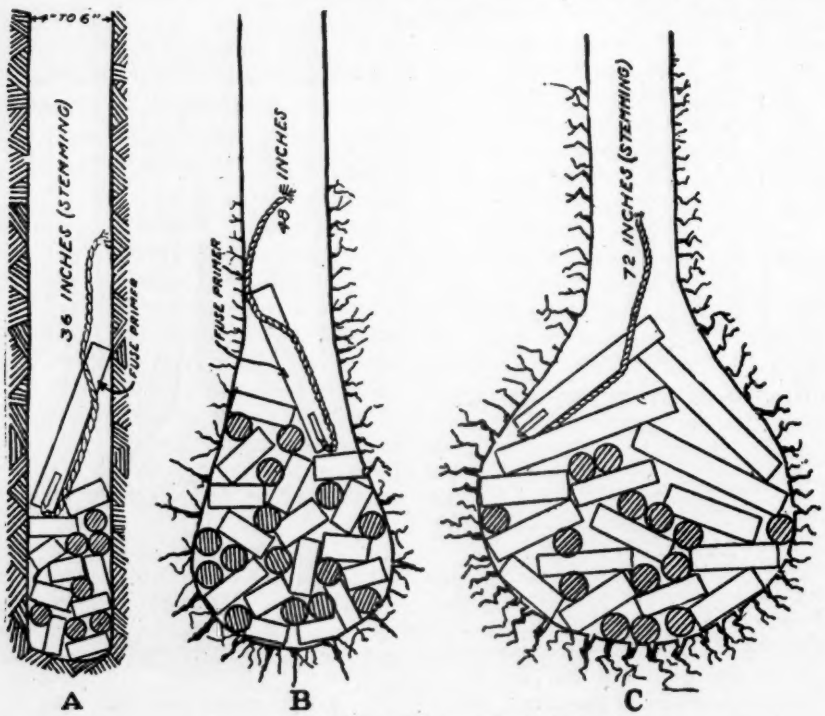


FIG. 4. SUCCESSIVE CHARGES FOR SPRINGING.

tom. After this 2 to 4 gallons of water is poured in as "stemming," the gage is quickly withdrawn, and the chargeman retreats to a safe distance. After the detonation the gage is again lowered and the size of the chamber estimated. If necessary other springing charges are used, each about twice as large as the preceding one, until the hole is sufficiently widened or chambered out at the base to receive a proper blasting charge, Fig. 4. For the third springing, where the holes are over 30 feet deep, and often for the second springing if much water is present, electric detonation is used, Fig. 3, B and C. Where there are several holes to be fired simultaneously electricity is employed instead of fuse. The lead wires or detonating wires are connected in series and the detonators tested with a galvanometer. The lead wires are then connected with a battery and the charges are fired.

CHARGING AND FIRING

The blasting squad usually consists of a charge man or powder man and four helpers.

The charge man places all explosives in the drill holes, except in the "springing" of short holes, when the work may be done by the assistant charge man. The helpers carry the explosives and accessories to the charge man while he is gaging the hole and charging it.

The amount of the charge for each hole varies according to the toughness of the rock, the position of the hole with relation to the face and to other holes, and its depth and extent of chambering. The drill holes to be blasted are "bank holes"—those drilled vertically on each bench and situated back approximately one-third of their depth from the edge of the bench—and "toe holes"—those driven into the face of the bench, say, 4 to 6 feet above the shovel level at the foot of the bench. The toe holes are driven with a downward slope of 20° to 30° below the horizontal.

When the holes are sufficiently chambered or sprung and are ready for loading, an electric-detonator primer, prepared as shown in figure 8, C, is carefully lowered to the bottom of the hole. The first part of the charge, varying from 100 to 300 pounds, is dropped in after it. Another primer is then placed in the hole and the remainder of the charge, 75 to 250 pounds, is added, Fig. 5. During the process of loading, the charge man frequently drops in his gage, to determine how rapidly

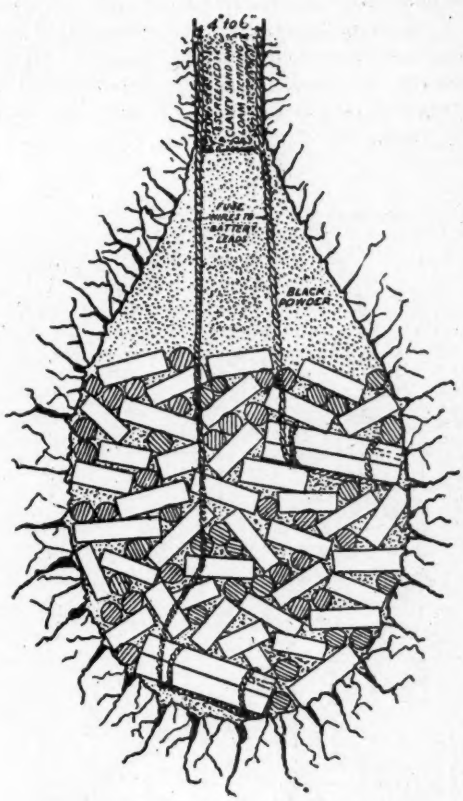


FIG. 5. THE FINAL CHARGE.

the hole is filling and to guard against the clogging of the powder. Often granulated Trojan powder is poured in to fill the interstices between the sticks of dynamite and the fissured places in the rock, Fig. 5. Thus air spaces are minimized and the efficiency of the blast greatly increased. When the charge is all placed, screened clayey sand and loam are carefully shoveled into the hole and packed down for stemming.

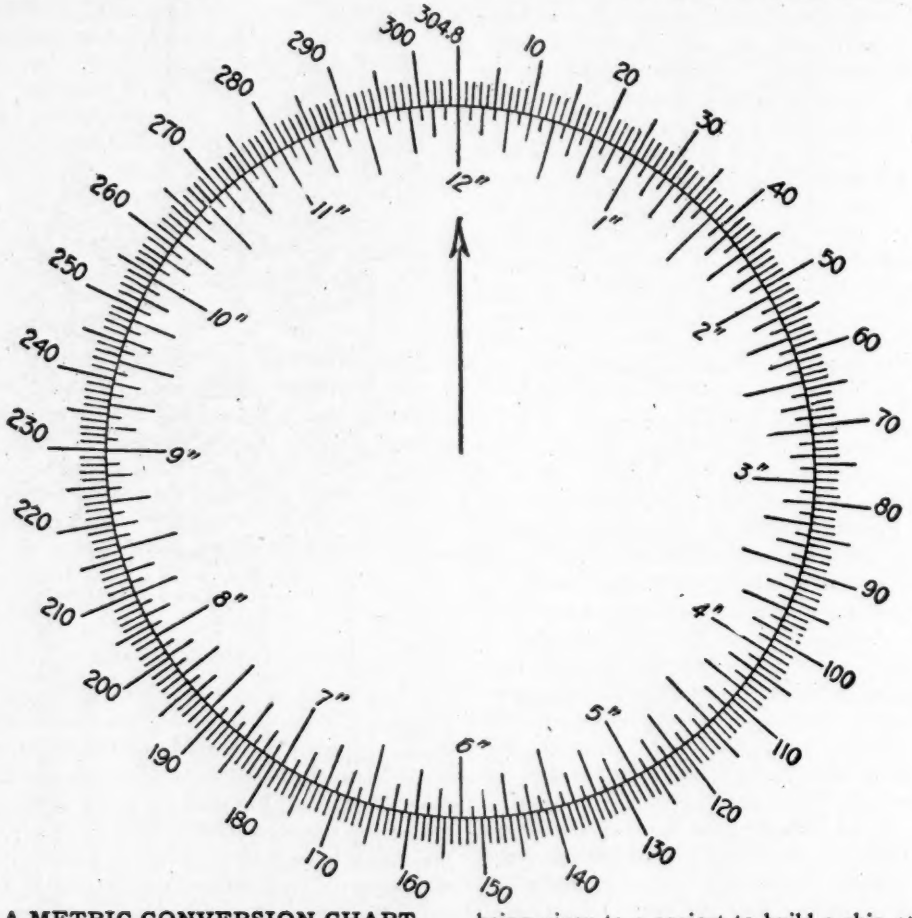
All blasting is done at such time as will least interfere with the operation of steam shovels, trains, drilling machines and general work. Wherever practicable the blasting is done at the end or before the beginning of the shift or during the noon period. A great deal of blasting is also done by the night squad.

The rules of the company prohibit more than one independent charge in any hole; that is, the explosives must be so placed that no stemming separates any part or parts of the total charge in any hole. Double or triple charges, separated by stemming, are not al-

lowed to be put into one hole, owing to the danger from incomplete detonation. A part of the charge under such conditions might not explode, thus rendering subsequent steam-shovel operations dangerous, for unexploded dynamite is sometimes set off when dug into by steam shovels.

such conversion charts could be carried in a little leather case, to be slung over the shoulder, not much bigger than an 8x10 camera and would not weigh much over 10 lb. and would render the compulsory use of the metric system just as simple as anything."

Serious consideration in Great Britain is being given to a project to build a ship canal across the middle of Scotland, linking up the Firth of Forth with the Firth of Clyde. This would give a short route from the North Sea to the Atlantic Ocean.



A METRIC CONVERSION CHART

We reproduce on this page a metric conversion chart which has appeared in two or three of the publications of the Hill Publishing Company, and we have taken the trouble to enlarge it to actual dimensions measured circumferentially. It of course requires no explanation, the inches and fractions being on the inside and the equivalent millimeters on the outside. It is ingenuously suggested that "similar charts could be made for feet, yards, miles, units of area, ounces, pounds, pints, quarts, gallons, etc. A collection of

SELECTION OF EXPLOSIVES FOR DIFFERENT QUARRY CONDITIONS

The following list of explosives and of the various quarry conditions for which each is most suitable is embodied in an article in the Du Pont Magazine by S. R. Russell in which he describes various quarry methods:

LIMESTONE USED FOR FLUX OR LIME MANUFACTURE

	Extra Dynamite or Arctic No. 6.
Bench System: Small Tripod Holes	30% to 40% Red Cross
Snake Holes	Spring with 40% R. C. N. G. and load with 40% R. C. Ext. or Arctic No. 6.
Well Drilling: Heavy Ledges	50% to 60% straight in the bottom and 30% to 40% R. C. straight or Arctic Powders on top.
Thinly Laminated	40% to 50% N. G. in the bottom and 40% R. C. Extra on top, or Arctic Powders.
Cliff Quarries	Spring with 40% R. C. Straight, load with Du Pont FFF Black Powder.
Hard Limestone, Using the Tunnel Method	Du Pont RRP and 40% R. C., using about 80% of RRP and 20% Dynamite.

HARDER LIMESTONE FOR COMMERCIAL PURPOSES

Bench System	40% R. C. Ext. or N. G., according to the degree of hardness.
Snake Hole Method	Spring with 60%, load with 40% R. C. N. G. or 40% Gelatin.
Well Drilling	60% Dynamite in the bottom, 40% R. C. on top or Arctic Powders.
Cliff Quarries	Spring with 40% R. C. Straight and load R. R. P.
Tunnel Method	Load with Du Pont R. R. P. and 60% N. G. 80% of total load R. R. P. and 20% Dynamite.

GRANITES AND TRAPS

Bench Holes	40% Straight.
Well Drilling	60% Straight or Gelatin.
Snake Holing	60% Straight or 60% Gelatin.

SAND QUARRIES

Where sand is used for manufacture of glass, for molding or other purposes.

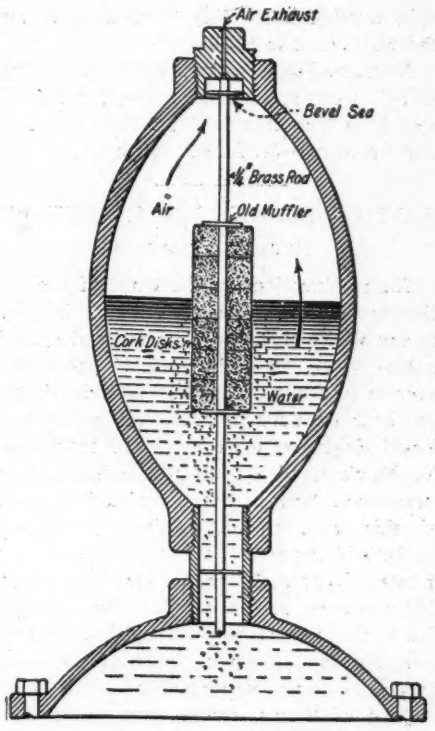
Bench System	30% R. C. Extra or Arctic No. 6.
Well Drilling	30% R. C. Extra in the bottom and Du Pont R. R. P. on top or Arctic No. 6 all through.

SLAG QUARRIES

Red Cross 25% Extra or Monobel No. 6.

SHALE QUARRIES

Red Cross 30% Ext. or Arctic No. 6 or a combination in well drilling of the above and Du Pont R. R. P.



AIR RELIEF ON PUMP DISCHARGE

We were constantly annoyed by air in the suction pipe leading to our water-supply pump at the United States dry dock here (Keokuk, Iowa). The 4-in. pipe, about 150 ft. long with an 8-ft. lift, is designed for fire service as well as for the ordinary supply about the grounds. The water passes so slowly through the pipe under ordinary circumstances that air collects in the pump and the discharge loses its pressure and allows the pump to run away. It occurred to me to get rid of the air in the manner shown.

A 2-in. nipple was screwed into the cap on the pump chamber and an old muffler of cast iron was connected, as shown, with a float, etc., to act as an air reservoir and relief so that when the air collects it is automatically discharged and the pump keeps on working, discharging air from this snifter valve and water

to the service main. This has given entire satisfaction and works perfectly without any attention. We do not think there is any leak in the suction pipe, but simply a separating out of air from the water due to the vacuum. In cold weather apparently there is more air in the water than in hot.

A glass of water drawn from the city mains in cold weather looks milky, with air bubbles, and it is this dissolved air that our snifter takes care of.—*M. Meigs, in Power.*

BRITISH ENGINEERS IN THE WAR

BY ONE AT THE FRONT

The ramifications of the work of the Royal Engineers are so numerous that it is difficult to say where their work begins and ends, but it may safely be said that it begins with the experts in the munition factories in England, and ends with the tunneling companies of the Royal Engineers in front of our front line in No Man's Land and on all the lines of communication, both in France and other theatres of this war, making sidings, constructing roads, bridging rivers, and making huts for the troops. Nearer the front line their work is still more in evidence when the upkeep of roads, the construction of light railways require constant attention. In this war the construction of dug-outs underground for the safe housing of troops, secure from the effect of shell fire, is of great importance. These dug-outs are constructed in the front line and right back to our supports. Battalion and Brigade headquarters are now all built underground, and well protected from high explosive shells. Most of this work falls to the Royal Engineers assisted by the Infantry and Cavalry as fatigue parties. They are also responsible for the wire entanglements in front of our lines, though the work is now largely given over to the Infantry who hold the lines, but the Royal Engineers have to supply the wire, stakes and tools for this work. The laying out of trenches and traverses also comes within their sphere. The riveting of trenches, the supply of duck-boards for the bottom of trenches, and the making of "sump holes" for drainage, also the supply of all timber, planks and engineering stores of all kinds are in their hands. They have a large army of carpenters, blacksmiths, timber men and experts at almost every trade at the front.

TUNNELING

Several branches of the Royal Engineers have been formed, among others the tunneling and signalling companies. The tunneling companies were formed shortly after the war settled down into a trench siege system. They are made up of miners from all over Great Britain and her Colonies; their work is to keep our front line safe from attacks of enemy sappers, and to carry underground warfare into and under the enemy's first line. It may safely be said that the British miner has upheld the honour of the Royal Engineers, an honour which is always very jealously guarded. Then there is the signalling section, responsible for the telephone connection the Battalion Brigade and Divisional and Army Headquarters, and for the laying of advance lines during an advance; also for the supply of wire and instruments to the Royal Artillery, to connect their batteries with their observers in the front line.

In Gallipoli, the Royal Engineers were responsible for the building and maintenance of the pontoons and jetties for the landing of troops and stores. In the event of a retreat or an excavation, it is they who are responsible for the destruction of stores, ammunition and guns, and for the blowing up of railway lines, roads and bridges; just as when an advance is made, they are responsible for the construction of roads, bridges and railways. In fact they are responsible for the whole of our lines of communication from England to our front line, both in France and other areas of war, except for the strip of blue sea so ably guarded and held by our Navy, which has never allowed this communication—and a very large strip it is—to be interrupted or cut by the enemy.

AVIATION

As to the work of the aircraft in the field it would fill a volume, but attention may be drawn to the immense stride made in our air service and air defences, and the extraordinary progress in efficiency, and the good work our airmen have done both actively and passively in repelling Zeppelin raids. All this work has been done, and these great results achieved, since August, 1914. Truly a marvellous transformation in a little over two years! It is true of our Flying Corps as of other branches of our army, that its work is mainly to assist the "man with the bayonet." By its

continuous observation it is able to inform our Staff when and where a large concentration of the enemy is being made, and when and where an attack is likely to take place. It is able to so direct our artillery fire as to destroy the enemy's emplacements, knock out his guns and destroy his trenches, and play upon his lines of communication. By dropping bombs on railway centres and ammunition depots, the airman disorganizes the enemy's supplies. By hovering continually over our advancing troops he enables our artillery to raise or lower their curtain of fire or barrage, and with the aid of science, mainly through his aerial photographs, he enables our troops to know the exact position of the enemy's trenches and strong points.

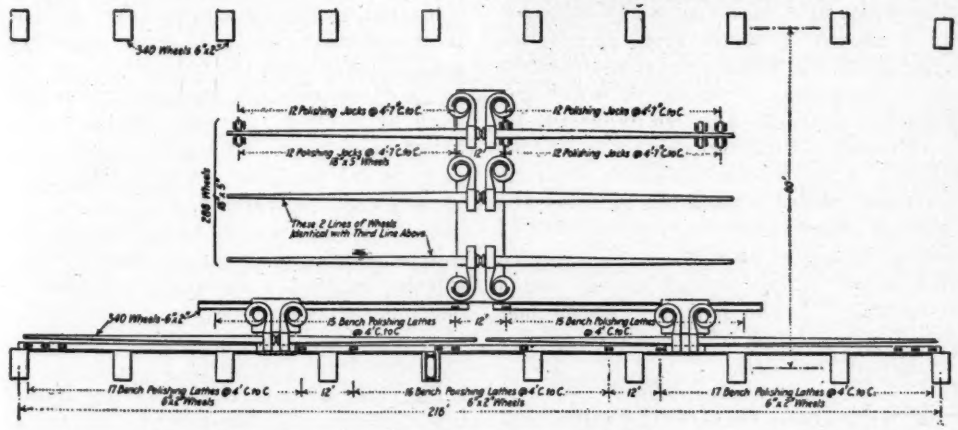

340 Wheels 6'x2"
12 Polishing Jacks @ 4'-7" C to C
12 Polishing Jacks @ 4'-7" C to C
12 Polishing Jacks @ 4'-7" C to C
4"x 3" Wheels
12 Polishing Jacks @ 4'-7" C to C
288 Wheels 18"x 5"
These 2 Lines of Wheels Identical with Third Line Above
80'
340 Wheels 6'x2"
15 Bench Polishing Lathes @ 4' C to C
12'
15 Bench Polishing Lathes @ 4' C to C
17 Bench Polishing Lathes @ 4' C to C
6'x2" Wheels
12'
16 Bench Polishing Lathes @ 4' C to C
6'x2" Wheels
12'
17 Bench Polishing Lathes @ 4' C to C
6'x2" Wheels
216'

FIG. 1. ARRANGEMENT OF POLISHING ROOM.

DUST COLLECTING BY WHOLESALE

BY JOHN L. ALDEN

Aside from the production machinery of the new plants of the Remington Arms Co. of Delaware, Eddystone, Penn., much of the auxiliary equipment is unusual and interesting. This is particularly true of the dust-collecting systems. Not only are these larger than the ordinary commercial installations, but their very size has necessitated some radical departures from what has hitherto been standard practice. One of these installations embodying some of the latest engineering developments has been designed and installed by the Oneida Steel Pulley Co., Oneida, N. Y.

The polishing room of this plant is 216x80 ft., lighted from above by skylights in the monitor, about 70 ft. above the floor. The general arrangement of the 628 polishing wheels is shown in Fig. 1. Across a wide trucking aisle is the browning department, which has two groups of 25 wheels and brushes each. The total number of wheels connected to exhaust systems is 678. Wheels 18x5 in. are mounted on the jacks in the middle of the room. Along the line of columns on each side of the room are two rows of small bench polishers fitted with 6x2-in. wheels or smaller. The wheels in the browning room are 12x4 in. and 12x5 in.

The two styles of dust hoods for the large wheels are illustrated in Fig. 2. Of these, 96 wheels operate as "overshot," while the remainder, 192, run in the opposite direction. Corresponding wheels on opposite pairs of jacks standing back to back are connected to the same branch pipe. The connection to each hood is rectangular and is equivalent in capacity to a 3½-in. round pipe. The bench wheels and those in the browning room are connected in pairs through rectangular breechings. The two wheels on the same spindle use the same branch. In the browning room each opening is equivalent to a 3½-in. pipe, while those of the small bench wheels are equal to 3-in. round branches.

The design of the hoods deserves comment. In Fig. 2, the hoods are hinged at the back so that the entire wheel covering may be swung completely out of the way when changing wheels or truing. In many respects this is a decided improvement over the ordinary hood with the side door. The "undershot" wheels in Fig. 2 had to be provided with the other style of hood, because there was not room enough between the wheel and the branch pipe to permit the top of the hood to swing back.

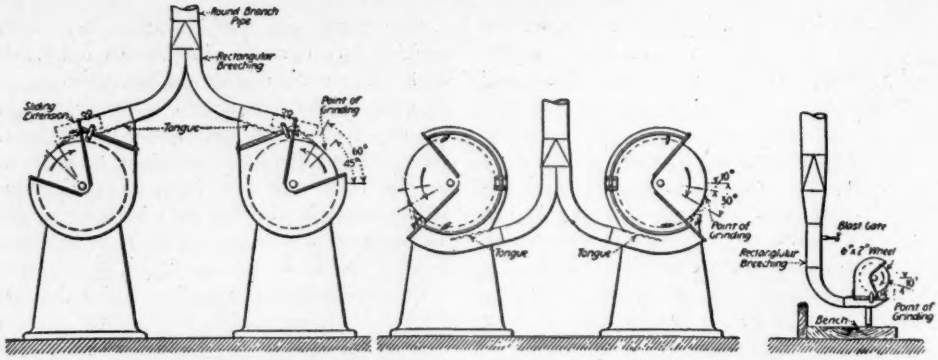


FIG. 2. DIFFERENT TYPES OF EXHAUST BREACHINGS.

Each of these hoods is so designed that the dust is thrown from the wheel directly into the mouth of the pipe. This gives a much better removal of dust than where the material is allowed to strike some part of the hood, losing the velocity acquired from the wheel. Each particle leaves the wheel at a mile-a-minute speed. If it can fly directly into the current of high-velocity air in the suction pipe, it will be removed with a minimum of external effort. If these bits of emery and metal are allowed to lose their initial speed by striking the side or back of a poorly designed hood, it will require a high vacuum and a strong blast of air to start them up the pipe from a state of rest. This is a recognized principle of hood design.

BALL-BEARING FANS

The large wheels are served by three large systems, each of which handles the dust from 96 wheels. The bench jacks are connected to four smaller systems along the side. In every case Oneida double exhausters, equipped with SKF ball bearings, are used. The construction of the blast wheel differs materially from standard practice. This is seen plainly in Fig. 3, which shows a small wheel with one side plate removed to expose the blading. When built in this manner the wheel is not only efficient, but extremely rigid. The use of high-grade ball bearings eliminates most of the ordinary fan troubles. The bearings are mounted in dust-tight housings, and when once packed with lubricant, need little attention.

WASHING THE AIR

The dusty air from each system is discharged into a pair of Gale centrifugal air washers, which thoroughly remove the dust, wash the air and return it to the room in a purified condition, entirely fit to breathe. Each double fan and pair of washers is erected as a self-contained unit, with water tank, strainer and pump. The small size of this unit as compared with the usual bulky dust collector is remarkable. But very little more floor space is taken up by the fan and washers than by the fan alone. The wash water is recirculated by a 1½-in. Goulds centrifugal pump belted to each fan. Each pump handles from 30 to 35 gal. per min. This is at the rate of about 1½ gal. per 1,000 cu. ft. of air, or about half that usually required by air washers. This is remarkably good economy when it is considered that the air washers at this plant are handling extremely dirty air. Several pailfuls of mud and lint are removed from the strainers every day.

Fig. 4 shows a plain view of one washer. The dirty fan blast enters at *A*, and in passing through the curved passage *B* the dust and lint are thrown against the curved outer surface of the washer, which is kept thoroughly wet by the three batteries of nozzles *C*. This effectively disposes of the heavier material, which is washed along the bottom to the drain connection to the strainer. In its passage through the outer washing chamber

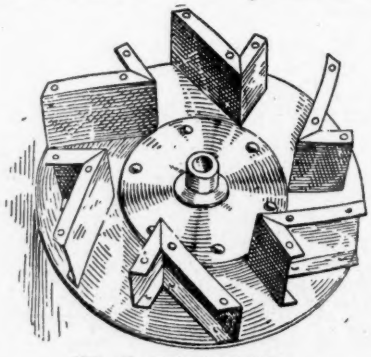


FIG. 3. BLAST WHEEL.

the finer dust becomes sufficiently moist and heavy to be thrown out of the air against the comparatively dry eliminating surface *E*. The sticky collection of mud on this surface is washed down by intermittent flooding from the nozzles *F*. The function of all sprays in this type of washer is to moisten the dust enough for it to be acted upon by centrifugal force and to keep the accumulated material washed from the curved surfaces. Very little dependence is place upon the direct wetting of dust by the sprays. As the name implies these washers depend upon centrifugal action for their best result. This is the reason why extremely dirty air is thoroughly cleansed with about half the volume of water ordinarily used for washing street air. After the washing operation the purified air is returned to the room through the outlet *D*, Fig. 4.

Owing to the close spacing of the double rows of jacks in the middle of the room, it was impossible to run the main-line exhaust pipes along the floor. A transverse power bridge of structural iron, from which the main motors were suspended, had already been erected. A timber deck on this steel framework provided a substantial footing for the three large double fans, washers and fan motors. This brought the center of the main-line pipes about 18 ft. above the floor, requiring vertical branch pipes 15 ft. long. Since it was not desirable to obstruct the floor space with pipe supports, the mains were slung from the roof trusses by cables and were guyed to the side columns. Along the sides of the room were structural bridges of the same height as the central one, carrying the shafting and pulley for the small bench polishers. At the proper points four smaller platforms were built on this bridge to accommodate the fans and washers. The motors for these fans were hung from the girders between columns, driving down to the fans at a 15-deg. angle. The main-line pipes for the small jacks were run along the top of the shafting support.

The preparation of the details shows considerable care. One of these points in particular, is the design of the small breechings by which each pair of wheels is connected to the branch pipes. Fig. 5 shows the construction of this piece. By making it of rectangular cross-section it is possible so to shape it that the two currents of air are flowing parallel at the junction point. This eliminates all losses due to eddies and interference of air currents, especially when one current is stronger than the other.

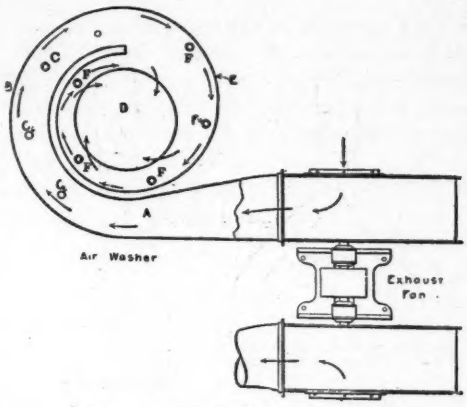


FIG. 4. PLAN OF AIR WASHERS.

All elbows and angles have a throat radius of two diameters of pipe and are made of metal two gages heavier than the corresponding suction pipe. A shorter radius than this causes too great a friction loss, whereas nothing is gained by using a longer radius, as experiments show that the reduction in friction is almost negligible beyond this point.

Vacuum, or "shoe," tees, Fig. 6, are used throughout as these have been found to give the most uniform result. They also have the advantage of providing a secure fastening, as they can be riveted to the main-line pipe on all sides. The ordinary 45-deg. round tee shows erratic pressure losses and cannot be riveted at the "heel," which makes an insecure connection. Each branch pipe is connected to the main-line tee with a detachable lug and bolt. This arrangement permits the branch pipe to be taken down without breaking a soldered joint, and at the same time a firm and solid connection is assured.

HAND HOLES FOR CLEANING

To facilitate cleaning, the main-line exhaust pipe is provided with hand holes at 10-ft. intervals. Each hand hole has a tight-fitting sliding cover, so that there is almost no leakage. The connection between the fan and the main-line is through a bolted joint fastened with angle-iron lugs and bolts. The removal of these bolts gives easy access to the interior of the fan through the inlet and also to one end of the main. The far end of the main is closed with a removable cap.

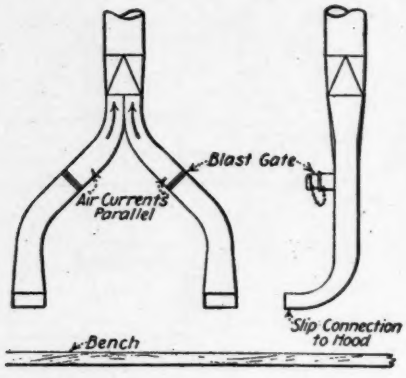


FIG. 5. BREACHING FOR BENCH POLISHERS.

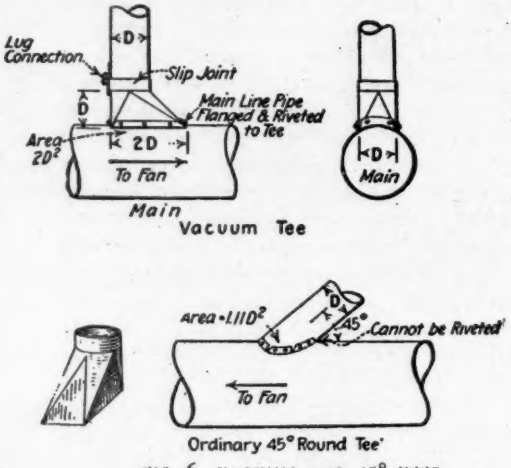


FIG. 6. VACUUM AND 45° TEES.

The galvanized steel used in the construction of the piping is of the following gages: For all pipes 12 in. and under, No. 24; 13 to 20-in., No. 22; 21-in. and larger, No. 20. All pipe is riveted and soldered, with the laps made in the direction of the air flow. Unusually heavy pipe supports of angle and band iron are used for holding the piping in place.

Particular attention was paid to the engineering features of the job. The pipe lines were designed for a uniform velocity throughout. A uniform vacuum of 2 in. of water is produced at each hood, the back pressure imposed by the dust separating and washing apparatus being reduced to a minimum. Competition was not allowed to influence the choice of the fan size or any of the important details. In a word, the entire installation was designed to produce the most economical operating conditions.

SAVING OF HEAT

In this installation it was absolutely essential to provide some means of purifying the air and returning it to the room. The exhaust requirements were 180,000 cu. ft. of air per minute, and under the old method this would have been discharged into an outdoor separator. To heat this air costs about $3400 a year. Had this heat been wasted, it would have been necessary to provide 44,000 lin. ft. of 1-in. heater pipe in addition to that now installed. Aside from the extra heating cost and the additional pipe involved, a very important item was the physical comfort of the men. Had this great volume of air been removed from the room, it would have been almost impossible to provide comfortable working conditions in winter without objectionable drafts and considerable discomfort on cold days, a condition that would hardly have been permissible.

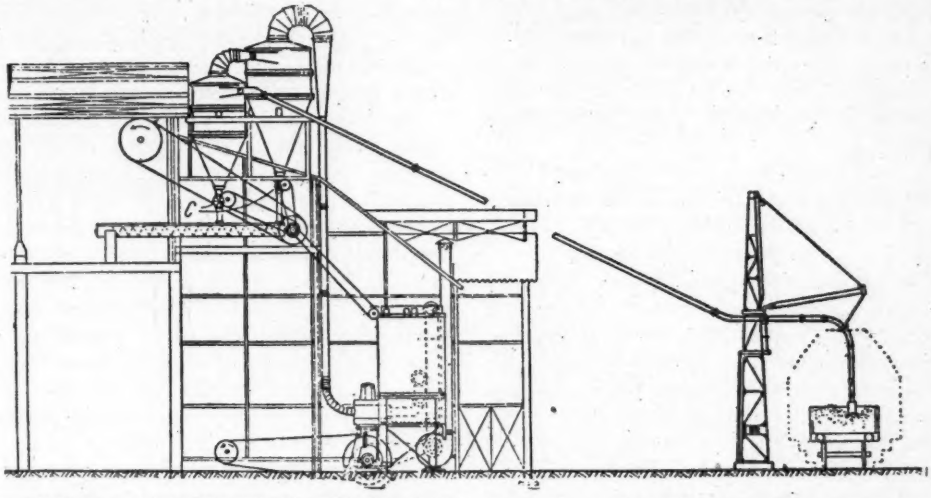
The argument may be advanced that the recirculation of this air in summer will create a close, humid condition. The plans are, however, to use Delaware River water as wash water during the summer, which will cool and dehumidify the air. It is possible to cool the air several degrees on a hot, moist day and to lower the relative humidity to a comfortable point when using cool water.

POWER CONSUMPTION

The power consumption of these systems is very low; 25-hp. motors drive the large double fans together with the recirculating pumps. These fans are equivalent in economical capacity to the ordinary No. 70 slow-speed double fan. The remaining exhausters, equivalent to No. 60 fans, are driven from 15-hp. motors. The vacuum produced is 3½ in. of water at the inlet of the large fans and 3 in. on the smaller ones.

The refinement necessary to produce the required results with a minimum expenditure of power and to save the heat that would otherwise be wasted is fully justified, as it is paying well over 100 per cent. on the investment. The specifications were unusually rigid and were more severe than those of the state labor departments. A complete guarantee of horsepower, vacuum and back pressure was

specified in the contract, and the whole was secured by a heavy forfeit. B. T. Converse, plant engineer of the Remington Arms Co., was responsible for the installation, and the fan department of the Oneida Steel Pulley Co. did the engineering and contracting.—*American Machinist.*



PNEUMATIC CONVEYOR FOR SLACK

The principle of the pneumatic conveyor, introduced (for grain) some 30 years ago by Duckham, has since been applied to other granular materials, including slack, owing to its convenience, the absence of dust, small space and little attention required. An installation of this type has recently been set up, at the works of the Deutsche Solvay Company, Bernburg, for discharging fine-grain brown coal from railway cars, which is accomplished at the rate of 15 tons per hour, without dissemination of dust, and without leaving any reminder to be removed by hand.

As shown in the illustration, an iron mast, set up by the railway track, supports a movable conveyor pipe by means of a jib. This pipe can be slewed, and can also be moved up and down by means of a winch at the foot of the mast. The suction nozzle terminating the pipe is guided to and fro by hand. From the mast, the conveyor pipe passes to a hopper, which is of large dimensions on account of the low specific gravity of the brown coal; and this hopper communicates with a second one (to the right), in which the dust arising from the coal is deposited. The mouths of both are closed by pocket-wheel valves C, which are kept in constant rotation to discharge the contents of the hoppers. A vertical air pump communicates with the conveyer pipe through the hoppers; and the discharged air is passed through a system of bag filters before being expelled into the atmosphere by a fan. A worm conveyor, underneath the valves C, delivers the coal to the fires. The same type of device might also be applied to the removal of ash and flue dust from producers, furnaces, etc.—*Stahl and Eisen.*

THE BIGGEST STACK

The largest stack in the world is located at Great Falls, the industrial and railroad distributing center of Montana. This stack is a part of the smelting plant of the Ananconda Copper Mining Company and is used to carry off the smoke and gases arising from the ore smelting plant below the hill on which this huge stack is built. The smoke passes through several flues into an immense dust chamber which has millions of wires hanging to collect the valuable mineral-charged dust, this chamber being the size of an average business block, after which it enters the flues leading up to the stack. The height of this wonderful piece of masonry is 506 feet, outside diameter at base 78 feet; inside diameter at base 55 feet. From these measurements our readers will see that the Washington monument which is 50 feet square at the base and 20 feet square at the top could be set inside of this chimney without touching any wall and there would still be room enough at any point between the

wall to drive a span of horses. A brick plant was established on the ground for the purpose of furnishing brick, 16,000 tons of which were used in the construction of this immense chimney. The weight of the stack is 34,000,000 pounds and it was built to withstand a wind of 120 miles per hour velocity. This big chimney, if used as a manufacturing plant would be equivalent to a 42 story building, quite a skyscraper in these days of high buildings. From the top of this great structure one may obtain a wonderful view to the south of the Little Belt and to the east the peaks of the Rocky mountains.

PRESSURE AND VACUUM WOOD PRESERVING PLANT

BY EDGAR W. BRIGHT

The Boston Electrical Railway Company has recently completed a timber treating plant at its South Boston yard which is the first pressure installation to be built by any street railway in the United States, and it embodies a number of interesting futures. The plant is under the direction of the writer and the designing engineer is Grant B. Shipley, of Pittsburgh, whose patents are embodied. The plant is adapted to treatment by either the full-cell or the Rueping process. It represents an investment of about $30,000, and has a capacity when operating two charges per day in nine hours of about 210,000 ties of 7,000,000 ft. B. M. per year using air-seasoned timber and treating by the Rueping process.

The treating plant is located near the south end of the property and is mounted on a solid concrete foundation. The installation consists of two storage tanks, a treating cylinder capable of handling lumber up to 50 ft. in length, a pressure tank mounted on scales, vacuum pump and compressor equipment and other apparatus, together with an unusually flexible piping system. All of the principal equipment except the storage tanks is installed in a cylinder house shown in plan in Fig. 1, and in cross-section and elevation in Figs. 2 and 3. The housing is of corrugated iron on steel framework.

The plant is one of the few installations in the country in which a standard gage track is operated into the treating cylinder. It is far more flexible than the ordinary installation, besides being remarkably compact. Steam is supplied by a pipe line connecting directly with the company's South Boston generating station, and creosote is delivered to the storage tanks by automobile trucks, provision being made in the piping to empty the truck tanks by either 20-lb. air pressure or by vacuum. This enables the trucks to be completely emptied.

The storage tanks are each 22 ft. 6 in. long by 9 ft. 9 in. in diameter, their capacity being about 13,000 gal. each. They are mounted on concrete saddles and are installed with horizontal axes at right angles to the longer axis of the cylinder house. The piping connections enable either tank to be utilized in serving the pressure tank, and live steam coils are installed in each to protect the creosote from freezing in the winter season. Provision is made for the drainage of these coils through a valve beneath each tank which is left slightly open when in service. Each tank is equipped with a safety valve and a stop valve controlling the delivery of oil to the interior of the establishment. Piping connections are also provided for the introduction of compressed air into the storage tanks to insure rapid delivery of oil to the plant, and throughout the plant the creosote is handled by air pressure. The shells of the storage tank are of ⅜-in. flanged steel, the heads being of ½-in. steel. An 11-in. by 15-in. manhole is provided at each head end.

Two compressors are in use, both being steam-driven. Nearest the storage tanks is an Ingersoll-Rand "Imperial" type XI horizontal high-duty duplex compressor and air pump, with 7-in. by 7-in. by 10-in cylinders, mechanical inlet valves and flywheel. This is supplemented in high-pressure work by a Westinghouse air compressor capable of handling 29 cu. ft. of air per minute at 80 lb. pressure and delivering it at 200 lb. pressure when operated on a steam line pressure of 135 lb. per square inch. The piping enables the two compressors to be connected in series through valve manipulation.

The working pressure tank, 9 ft. 9 in. in diameter and 22 ft. 6 in. high, is mounted in the cylinder house on a Howe tank scale of the registering beam type, with 10-ft. by 10-ft. supports and graduations reading in 10-lb. steps. The scales are designed to carry a tank of 38,000 lb. steady load, and 120,000 lb. variable load of creosote, a total capacity of nearly 160,000 lb. The working pressure tank is equipped with steam coils for maintaining the

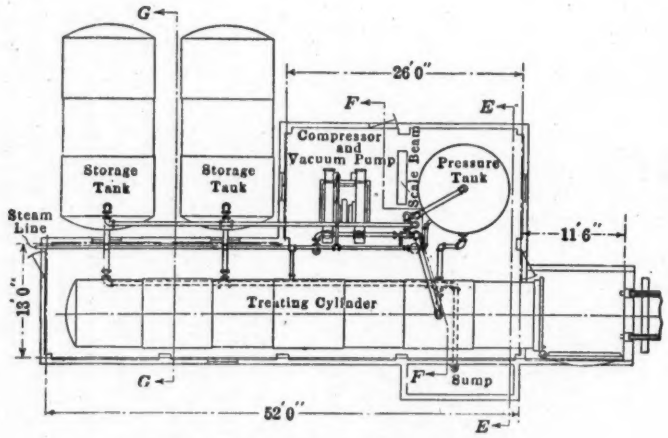
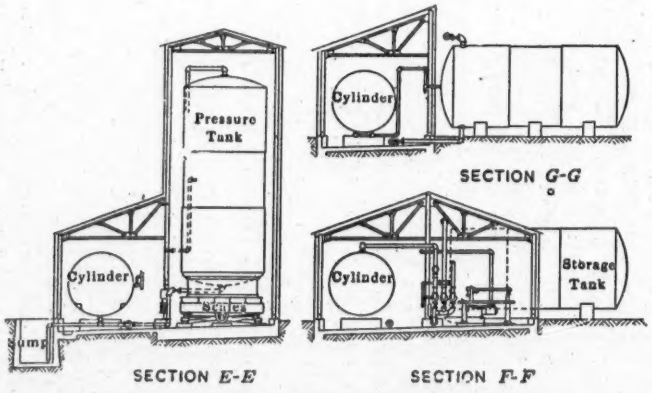


FIG. 1—PLAN OF CYLINDER HOUSE



For section lines see Fig. 4.

FIG. 2—CROSS-SECTIONS OF CYLINDER HOUSE

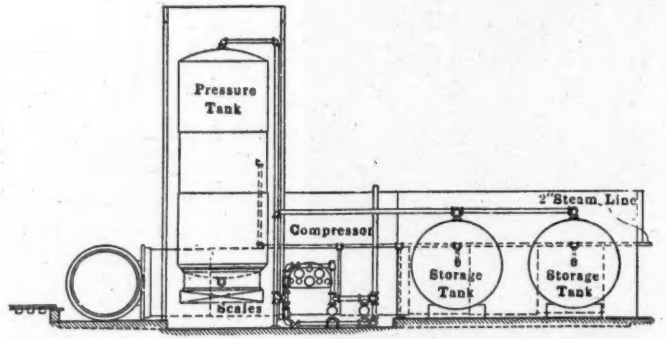


FIG. 3—LONGITUDINAL SECTION OF CYLINDER HOUSE

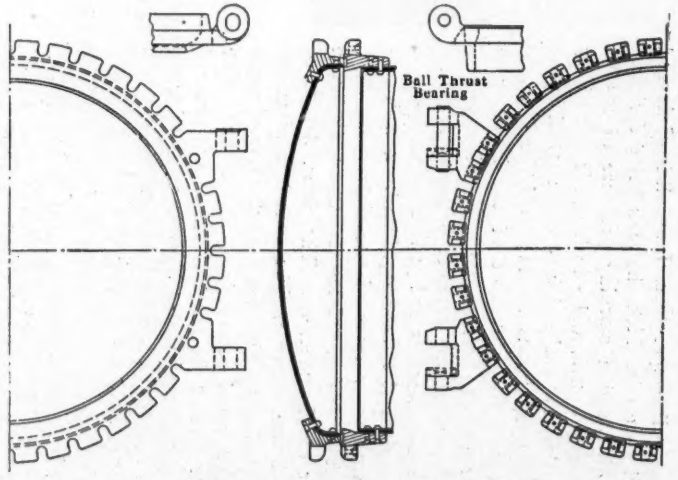


FIG. 4—DETAILS OF CREOSOTING CYLINDER DOOR

proper oil temperature. Its shell is of flanged steel plate 1-in. thick, the tank being designed to withstand a working pressure of 175 lb. per square inch, and a hydrostatic test of 265 lb. Ball-and-socket joints are installed in the air and oil mains leading into the tank, to care for the movement of the latter upon the scales as the creosote volume is changed.

The creosoting cylinder or retort is 7 ft. 6 in. inside diameter and 51 ft. 2 3-8 in. long. It has a shell of ¾-in. flanged steel made in seven courses or rings of one plate each. It is mounted on iron saddles resting on reinforced concrete foundations. The door, details of which are shown in Fig. 4, is located at the forward end. This has a steel frame of angle section bored accurately to fit the shell. The outer face of the frame is turned and grooved for a gasket. Fitting the frame and hinged to it is a heavy cast-steel door frame, to which is double-riveted a dished head of flanged steel, designed for a working pressure of 175 lb. and a test pressure of 265 lb. per square inch. The door is carried on two hinges supported by ball-thrust collar bearings. It is fastened by forty 2¼-in. T-head hinged bolts, each equipped with a steel washer and hexagonal nut. The door gaskets are of No. 600 "Ankorite" H. P. asbestos. The cylinder track consists of 4-in. x 4-in. x ¾-in. angles supported by six pressed-steel brackets per course. Fig. 5 shows a charge ready for insertion into the retort, the timber being mounted on special bolster trucks equipped with locking hoops. These hold about 10,000 ft. B. M. per charge, and tie cars hold about 420 ties per charge. The trucks are pushed into the retort by a service car equipped with an extra heavy bumper and loaded with discarded tie plates to provide the necessary traction. Charges are withdrawn from the retort by the same car through a wire cable attachment.

The full-cell process consists of impregnating the fibers and cells of the timber with from 5 lb. to 20 lb. of oil per cubic foot. In this operation the wood is either air-seasoned or steamed in the cylinder, sometimes both. This is done to reduce moisture and expel sap; then a vacuum is produced and maintained until the preservative is introduced and the wood is completely submerged. The pressure is then increased from 100 lb. to 150 lb. per square inch and maintained until the desired penetration has taken place, when the remaining oil is drained from the cylinder. Sometimes a vacuum is produced and maintained at the finish to drain the surplus oil from the outside surface of the wood to prevent loss of oil after the material is removed from the retort.

FIG. 5.

The Rueping or "partial cell" process consists of forcing compressed air into the pores of the wood; without releasing this air pressure, the oil is permitted to flow into the cylinder and air is displaced and forced into the top of the working pressure tank. After the wood is completely covered with preservative the latter is then forced into the wood to the required amount. The air pressure is then released and the preservative is drained from the cylinder. A vacuum is then produced which causes the air within the cells to expand and force fluid out of the wood, leaving from 4 lb. to 6 lb. per cubic foot. About 20 lb. maximum of air suffices to force oil from the storage tanks into the pressure tank. At the beginning of a run about 118,000 lb. of oil is in the working pressure tank. The oil temperature is usually about 170 deg. Fahr. before entering the retort. Steam coils are provided in the retort as well as in the other tanks above noted, and beneath the retort a sump about 9 ft. deep has been built to receive drained oil from the interior of the tank. This oil can be reclaimed by utilizing one of the compressors as a vacuum pump; in fact either pump may be operated on pressure or vacuum work, and the piping enables pressure or vacuum to be applied to either the retort or the working pressure tank as desired. An extra discharge pipe with check valve is also provided in the retort to enable

sap, water, etc., to be drained into a blind drain in case the full-cell process is in use. This enables the steam supply to be kept on the coils within the retort throughout any desired period. Before the introduction of oil in the Rueping process, air at 60 lb. pressure is admitted to the retort for about forty minutes, in order to open the cells for subsequent treatment. The amount of oil absorbed is obtained by scale readings instead of by the customary and less accurate system of weighted floats. The auxiliary equipment includes a full set of Foxboro indicating and recording pressure and vacuum gages, thermometers, etc., and Crosby pressure gages. A complete system of records of all work handled is maintained.—*Condensed from Electric Railway Journal.*

BENDING RAILS WITH A PNEUMATIC HOIST

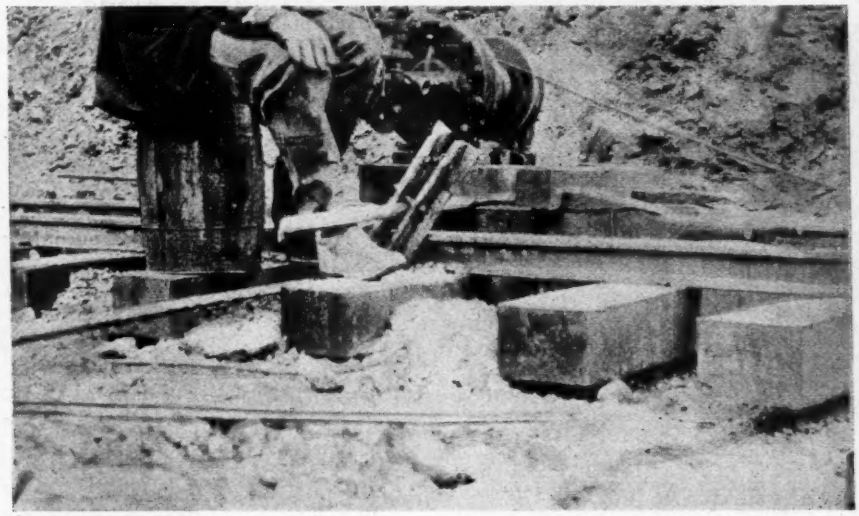
BY H. S. HICKS

The necessity for rail bending is not infrequent in mine-track work, and the usual method of cranking the rails through a rail-bending machine is a slow, back-breaking and sometimes a heart-breaking job.

The method of overcoming this condition at the surface plant of one of the Juneau (Alaska) mines, is interesting. Fifty-pound steel rails were being bent by hand with a three-wheel bender when the idea of using an air-operated "Little Tugger" hoist to pull them through was conceived. The rail bender was fastened on the track at a point where the curvature was approximately the same as that of the rails to be bent and the "Little Tugger" was placed a little more than a rail's length away. A rail was started through the bender and the hoist pulled it the rest of the way. The power required was of course considerable and when a curvature of short radius was required a block and tackle was sometimes employed, the hoist still doing the pulling but with a multiplied effect.

When cranking the bending machine by hand, eight men were able to bend but eight rails a day. With the assistance of the "Little Tugger," two men bent six rails per hour, the other six being kept busy carrying rails to and from the machine.

The hoist is bolted to a timber skid, as shown in the illustration. This arrangement



is easily anchored in any of the many places where the hoist is used, and at the same time two men can easily carry it about, an ample air supply being always available.

SYSTEMATIC SUPERVISION OF MACHINE DRILLS

An interesting innovation in the management of machine drills under ground has been made at the Franklin mine, in the Lake Superior district. As many as eight machine drills are run in a row all supervised by one expert mechanic. This scheme could well be copied by other mines that have stopes sufficiently large to justify that number of drills. The advantages are obvious; the bunching of machine drills pleases the miners, who like com-

pany in their work, and also in the matter of time in the correction of any minor difficulties that may arise. Although the machine runner in the Lake Superior District is of a superior type, nevertheless he cannot be expected to be as good a mechanic as he is a drill runner, and therefore the services of a mechanic at hand are of great advantage. Not the least benefit of such an arrangement is that it reduces to a minimum the likelihood of a drill runner losing his temper and hitting his drill with a sledge-hammer, whereupon it immediately becomes a candidate for the drill hospital.—*Eng. and Min. Journal.*

CORRECT PRESSURES TO USE IN FAN TESTING

BY JOHN L. ALDEN

The literature of fan testing is incomplete in regard to the measurement and use of the various pressures developed by the fan. It is the purpose of this article to show, not how to measure the pressures, but what pressures to measure.

The mechanical efficiency of a fan or blower is the air horsepower divided by input horsepower. The input to the fan may be measured in any of the standard ways. The output, or air horsepower, of the fan depends on the volume of air handled and the difference in pressure produced by the fan. The volume is usually determined by the use of the pitot tube, anemometer, Thomas meter, orifice or venturi meter. The pressure measurements are usually made by the use of a pitot tube, piezometer ring or static-pressure holes in the circumference of the pipe. All these have been fully covered in textbooks and published articles and will not be discussed here.

The total pressure existing at any point in a pipe is the algebraic sum of the static and velocity pressures at that point measured directly by the impact or dynamic orifice of the pitot tube. The dynamic pressure in the discharge pipe is always greater than atmospheric pressure and is therefore positive. In this pipe the velocity and static pressures are both positive. In the suction pipe the static pressure is always negative and greater, numerically, than the positive velocity pressure at the same point. For this reason the suction dynamic pressure is always less than atmospheric pressure and hence negative. The total pressure difference

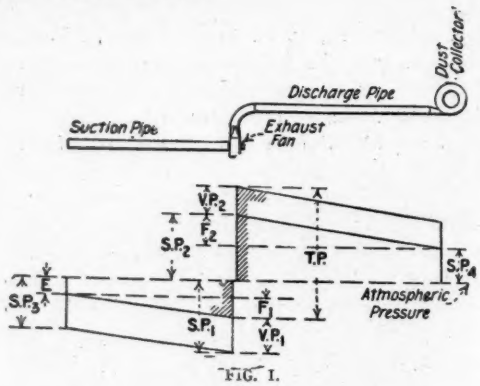


FIG. 1.

produced by the fan is the algebraic difference between the dynamic pressures as measured on the two sides of the fan as shown in the diagram, Fig. 1, where

$T.P.$ = Total pressure developed by fan;

$S.P._1$ = Static pressure at fan inlet—negative;

$S.P._2$ = Static pressure at fan outlet—positive;

$S.P._3$ = Static pressure at end of suction pipe—negative;

$S.P._4$ = Static pressure at entrance to collector—positive;

$V.P._1$ = Velocity pressure at fan inlet—positive;

$V.P._2$ = Velocity pressure at fan outlet—positive;

$F._1$ = Friction loss, suction pipe—negative static pressure;

$F._2$ = Friction loss, discharge pipe—positive static pressure;

$E.$ = Entry loss, suction-pipe inlet—negative static pressure.

This represents an exhaust fan drawing air through a suction pipe and discharging it into some sort of dust collector or receiver, through a discharge pipe of different diameter from the suction pipe. The discharge pressures are represented graphically as falling above the atmospheric line and the suction pressures below. The only pressures essential to the computation of the air horsepower of the fan are the two static and two velocity pressures measured at the fan. For a proper understanding of the composition of these pressures, the diagram has been extended to show the conditions at the ends of the suction and discharge pipes. The static vacuum at the mouth of the suction pipe consists of that part which produces the inlet velocity and

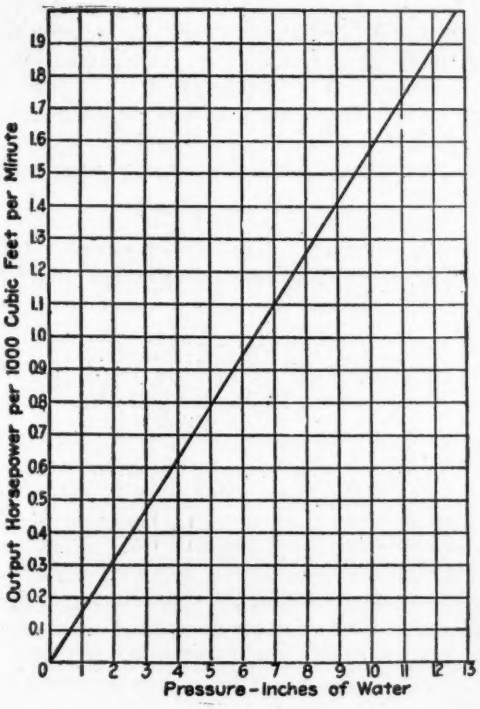


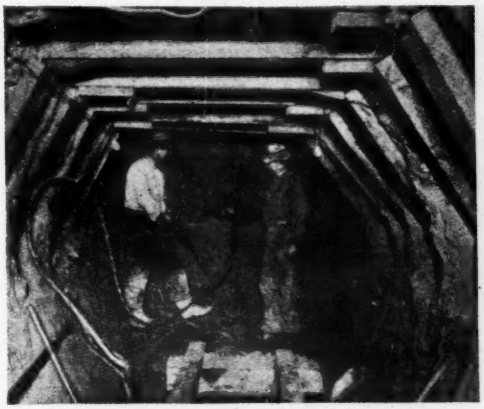
FIG. 2.

that necessary to overcome the entry loss due to the contraction of the liquid vein. The difference in static pressure at the two ends of the pipe is used in overcoming friction and eddy losses. The static pressure in the discharge pipe is that required to overcome friction and the resistance imposed by the dust collector.

A number of published accounts of fan tests give erroneous results and conclusions because the calculations are based on the wrong pressures. It is customary with many engineers to base their figures on the sum of the two static pressures and the discharge velocity pressure. As one velocity pressure has already been included in the static suction, it is plain that this method gives the fan credit for creating more pressure than it actually does. It is too high by the amount of the suction-velocity pressure, and consequently gives too high an efficiency. This method is correct only when the inlet velocity is zero, which never occurs when the fan is delivering air.

When the inlet and discharge pipes have different areas, the numerical sum of the two dynamic pressures must be used as the true total pressure produced by the fan. If the two pipes are the same size, the sum of the static pressures is identical with the sum of the dynamic pressures. If a correct test of an open-inlet blower is desired, it will be necessary to attach sufficient suction piping to enable the static suction to be measured. If accuracy is not essential, it will be necessary to figure the inlet velocity from the discharge velocity by using the ratio of the discharge area to the net inlet area. In addition, the loss at entry into the fan inlet must be estimated and considered as part of the static suction pressure. To do this it will be necessary to assume a coefficient of influx corresponding to the general shape of the inlet.

When the proper pressures and the volume of air have been determined, the air horsepower of the fan may be quickly found from the curve, Fig. 2, based on a 30-in. barometer and 50 deg. F.—*Power.*



EARTH TUNNELING WITH PNEUMATIC COAL PICKS

Labor cost of tunnel excavation was reduced one-third on Milwaukee sewer tunnel work by substituting pneumatic tools for hand picks and mattocks in cutting down the hard earth working face. The illustration here reproduced from The Contractor, Chicago, shows the work in progress with pneumatic chisels or modified coal picks.

The sewer built in tunnel was 78-in. circular concrete, filling the tunnel excavation. The tunnel was approximately 7,000 ft. long and was at an average depth of 75 ft. below street surface. About two-thirds of the work was in very hard clay and probably one-third in a material that would be called hard pan.

Shortly after the contract was taken, trouble in securing labor developed and wages went

up. To meet the difficulty the use of coal picks was suggested to the contractor and he purchased twelve machines, using two in each heading and running four from each shaft with a 10x10 in. compressor.

The coal pick used was one of the ordinary pneumatic hammer type, as shown by the illustration, but having a chisel shaped cutter with a blade edge of about 3 in. and a blade bent like a shovel blade in respect to the stem or haft of the tool. In operation the workman held the tool so that a shaving of earth was peeled off the earth face.

Using the pneumatic tools two miners made an average of 8 ft. of tunnel per day. Previous to using the tools three miners were excavating 5 ft. of tunnel per day. The labor cost on the job was reduced 33⅓ per cent.

The contractor for the tunnel was the Wisconsin Tunnel & Construction Co., Milwaukee, Wis., A. F. Hewitt, president.

PRECAUTIONS IN BLASTING

Never open a metal keg of powder with a pick or metal tool. Use the opening provided by the manufacturer of the keg.

Never return to a shot that has failed to explode until at least 10 min. after lighting it, if squibs were used, or 12 hr. after lighting if fuse was used. When shots are fired electrically be sure that all wires are disconnected from the battery, and wait at least 5 min. before returning to the face.

Never allow powder or other explosive to remain exposed. Keep it in a well-locked box at least 100 feet from the working face and in an unfrequented place.

Never go near a powder box or powder when smoking.

Never allow the point of the drill to become dull or to become of less than the standard gage, so that a drill hole may be made with it into which the cartridge may always be pushed freely.

Never withdraw a shot that has missed fire. Drill a fresh hole at least 2 ft. from it but parallel to the old hole and fire this new hole. After the shot a careful search should be made for the unexploded charge to prevent its being struck by a pick and perhaps causing an explosion.

Never use iron or steel tampers or needles. Have at least 6 in. of hard-drawn copper on the tamping end of the bar or, better still, use a hardwood tamping stick. The needle should be made entirely of hard-drawn copper.

Never tamp shots with an iron or steel scraper, and do not push a cartridge into the drill hole with the scraper. The scraper rod should be tipped with at least 6 in. of brass or copper on the scraping end.

Never take more than one day's supply of explosives to the work at one time.

Never leave explosive on the work over night.

Never attempt to use frozen dynamite.

Never crimp a "cap" with the teeth. This practice is dangerous. Use the crimper.—*Miners' Circular 7a.*

GASOLINE SAVES THE LIFE OF A LINOTYPE MACHINE

The Oklahoman has this story to tell:

R. E. L. Brown, mechanical superintendent of the Oklahoma Publishing Co., did some quick inventing when news came of the break in the gas main Saturday. Fierce heat of gas jets is necessary to heat type metal in the linotype machines. Gasoline flames are the only substitute for gas flames in heating type metal. The linotype machines are not equipped with gasoline attachments because the gas supply is supposed to be as constant as the coming of night and day. So invention was needed.

Brown rushed to a hardware store just before closing time Saturday night and asked for gasoline burners or gasoline stove fixtures. We don't carry 'em," he was told.

"Give me two gasoline stoves!" Brown demanded. He got them. Then he bought eight gasoline torches, the kind the patent medicine show man swings from a pole to draw crowds at night and illumine the negro banjoist. Back in the composing room of the Oklahoman plant, Brown and two assistants began to apply the torches and gas stove burners to the linotypes. A linotype machine is a complicated mechanism. Attachments must be complicated. But in an hour one machine was turning out lines of type under the action of the gasoline burners. Then one by one seven machines were put into action.

Coal grates were hurriedly placed beneath the huge pot which melts the metal for the stereotyping machinery. The linotypes clattered. The forms of type were rushed to the stereotyping room, the plates were made and rushed down to be clamped upon the presses. The boss pressman turned the switch and the first edition rolled off on time.

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BARGAIN TIME

The fullness of the heart compels the mouth
To speak, and wonted themes must wait awhile.

The time has come when we must make our stand
For many things which never until now
Had need of guarding hand. We went along
Pursuing each our self-planned schemes, though still
With help of each for each, and not without
The rivalry that spurs all to their best.
Until this darksome shadow sharply fell
There never was a time when all the earth,
Well filled with comfort and content,
Could look so trustfully on days to come.

It must have been a dream, for suddenly
'Twas all upset and horror and dismay
Began to flood the earth. The peaceful arts
Gave way to war's demands. The industry
Which for so long had toiled to clothe and feed,
To brighten and to smooth the path of life,
Was turned instead to sow grim seeds of death,
With crop of desolation and despair.
The fiendish boast may now be surely made
That blacker, bloodier page was never writ.

America we thought might still be safe
To be a mere onlooker, though with teeth
Tight clenched as raged the wanton wickedness;
But this was not to be. No place appears
For us to stand aloof. The world is one,
And we are in and not outside it, while
Our schemes and interests touch all mankind.

A constant interchange of things which each
Has better than the other helps us all.
Across the seas we have both bought and sold,
With many friendly visits back and forth;
But this must all be stopped on pain of death!
Almighty God perhaps might make such threat,
For reasons that to us did not appear,
But who on earth has impendence so vast
To arrogate the claim

The record stands
Incredible but true, the word swift matched
By deeds which we could not believe
Were possible for man to plan and do.

It is a world-surprise whose ruthlessness
Still has its swing. And this to face and down
Is straight before us as the only way.
Our duty never is experiment,
But always what both can and must be done,
And in the end, though near or far, it wins,
And is the one thing sure.

Our thought is all
Upon the present and the future, with
No slightest plan for righting what is past
Or dealing punishment where well deserved,
We are to be diverted by no plea,
Divided by no claim of fatherland
Across the sea, which we have rightly loved,
It is our homeland and our children's land
That stands supreme.

We know not what the price
We yet must pay to make our homes and lives
Secure, the time required to crush and grind
And utterly annihilate the crew
Now raging wild; but we can pay the price
And we can bide the time to make us sure
Of bargain everlasting. R.

NEW BOOKS

Mechanical World Pocket Diary and Year Book, Manchester, England, Norman Remington & Co., Baltimore, Md. 450 pages, 4 by 6 in. Price $0.35.

This compact volume, now in its thirtieth year of publication, comprises an extensive collection of handy tables and various useful data for engineers and mechanics in general, kept up-to-date from year to year. It of course contains numerous advertisements which alone make its publication possible, but including these it is handy to have and convenient for the pocket.

Income Tax Procedure, 1917. By Robert H. Montgomery. The Ronald Press Co., New York, 470 pages, 6 by 9 in. Price $2.50.

This book, though not devoted to the topics with which we are most familiar, cannot fail to be of interest to many of our readers. Those who look into it will be likely to look deeper on account of the surprising complication of the problem considered, and those of us who are so fortunately unfortunate as to come under the exactions of the law will welcome the information and the suggestions it contains, especially as to what does and what does not constitute income in the eyes of the law. Mr. Montgomery characterizes the existing income tax as most vicious, in that it encourages Governmental extravagance and removes accountability for it.

LUBRICATION AND CARE OF PNEUMATIC TOOLS

A booklet recently issued by the Chicago Pneumatic Tool Company deals with the above important topic. It is pointed out that unless pneumatic tools are kept clean, well lubricated and limited to the uses for which they are intended, they will not give the service for which they are designed. To keep the working parts of the tools clean and free from particles of foreign matter, the first thought should be given to the air itself. Wherever possible, the air supply should be drawn from some point outside the building where the air is most apt to be clean, cool and dry. In any event, a strainer should be placed over the exposed end of the inlet pipe. Such a strainer can be easily made by covering the opening with wire netting over which one or two layers of muslin have been placed. While under ordinary conditions the strainer is not essential, it helps to avoid a great many possible lubrication troubles, and not only adds to the life of the valves, piston and glands of the air compressor, but assists in keeping the dirt and grit out of the working part of the tools.

[In this connection it should be pointed out that to put a wire netting over the end of the intake pipe, and especially to cover the netting with muslin, would be to choke the intake and materially reduce the volume of air compressed and delivered per stroke. The air filter or strainer should be a hood or box of any convenient shape but with a surface area much greater than that of the pipe section. Arrangements should also be made for washing or otherwise cleaning the filter surface from time to time].

A strainer should also be placed in the pipe lines leading directly to the pneumatic tools, and special strainers are made to insert between the pneumatic hammers and the hose nipple.

OIL PARTS FREQUENTLY

In the lubrication of pneumatic tools, judgment should be used, for there are some machines or portions of them that require a light

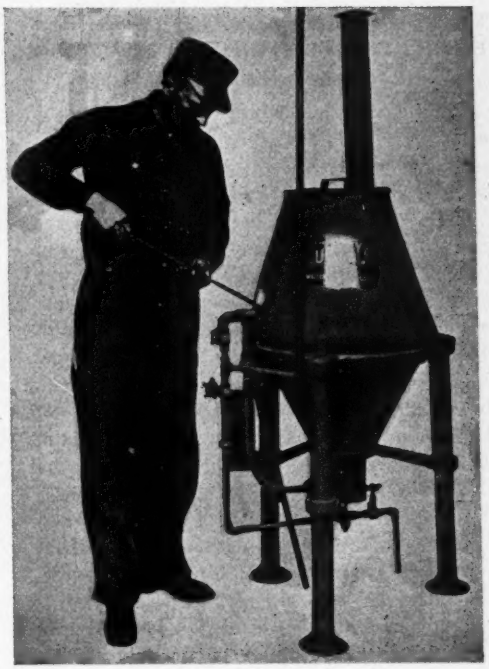
machine oil and others that require a heavy grease. Valves and pistons for both hammers and drills require a light machine oil, and as the compressed air which comes in direct contact with these parts has a tendency to drive the lubricant out through the exhaust, it is advisable to oil such parts freely and often, about once every hour while the tool is in constant use. Such portions of the tools as the gear and crank cases to which the compressed air does not have direct access are best lubricated with grease. This grease may be forced into the crank cases through the dead air handle by means of a squirt gun or syringe. A filling every 10 hours while the drills are in constant use gives the best results.

It is a good plan to immerse pneumatic hammers in a bath of benzine or kerosene over night and then blow them out under pressure the following morning, after which they should be thoroughly lubricated, with a light machine oil.

COMPRESSED AIR IN METAL PRESS WORK

Many up-to-date shops use compressed air in the press rooms. It may be supplied by piping that connects the compressor tanks with each machine, or by a small pumping attachment bolted to the main casting of the machine. While compressed air is rather expensive, its great cost-reducing powers and economic value in shop manufacturing operations, especially press work, more than offset the first cost. It may be used for removing work from dies, blowing work through open-back presses into work boxes, removing work from certain style jigs in the drill press, keeping dies free from scale, chips, and dirt, removing punchings from tapped holes, furnishing power for automatic feed devices and for the side stroke in double-action dies; it has also been used as a bumper pad for the pressure ring in shell-drawing dies.

In looking through the Patent Office Gazette each week we note some interesting things. Here, for instance, is the entire claim to cover a new process for preserving eggs:—"The process of preserving eggs, the same consisting in immersing the eggs in a solution of *Desmodium tortuosum meibomia* in proportions of substantially one pound of *Desmodium tortuosum meibomia* to one gallon of water."



A SAND BLAST FILE SHARPENING MACHINE

The illustration shows a special file cleaning and sharpening machine built by the Macleod Company, Cincinnati. It uses compressed air, preferably not under 80 lb. pressure, and a special flint abrasive which can be used over and over again, the waste being replacable at reasonable cost. A blast of air from a fixed jet within the head and carrying in suspension the abrasive flint is directed upon the file which is thrust in through an opening in the front. The angle at which the file is introduced is fixed by guides just inside the opening. The file is pushed slowly into the drum and withdrawn a few times, the number depending upon the condition of the file. The abrasive, after striking the file surface at the proper angle, taking away all foreign material and leaving the file clean and sharp, drops into the bottom of the drum. It is then ready to be siphoned up by the jet and used over again. The apparatus can be used also as a sand blast for small castings, a hand-hole in the top being provided through which the castings may be introduced.

THE FUNCTION OF HIGH AIR PRESSURES IN BESSEMER CONVERTERS

BY W. TRINKS*

Practice has settled on blast pressures of 20 to 30 pounds per square inch for converters. Among those who are not thoroughly familiar with converter practice the impression prevails that this high pressure is necessary to deliver the air against the pressure caused by the liquid iron (ferrostatic pressure). Calculations based on actual converters show, however, that ferrostatic pressure at the bottom of the vessel varies between the units of 3 to 5 pounds per square inch, so that the question arises: Why the other 17 to 25 pounds? For the purpose of solving this question a test apparatus was installed in the Mechanical Engineering Laboratory of the Carnegie Institute of Technology.

Among the theories advanced for the necessity for the high blast pressures is the contention that the excess pressure is needed to keep the molten iron from flowing down into the tuyeres. It is well known that air and liquid of equal pressure, filling a pipe, will arrange themselves so that the liquid is at the bottom. It has been claimed that the iron would flow back, if it were not for the very great speed with which the air flows upward through the tuyeres.

In order to test this theory, the 6 in. pipe constituting the experimental converter was filled with mercury to such a height that the pressure at the bottom, that is to say at the mouth of the tuyere, was 4 pounds per square inch. The tuyere was 21 in. long, with a diameter of ½ in. The converter tube was righted from horizontal to vertical position with a pressure of about 10 pounds per square inch. The pressure was then gradually reduced, until the mercury ran back through the tuyere. This point was determined by the appearance of the mercury in a gage glass under the tuyere. Much to the surprise of the observers, the mercury did not appear in this gage glass until the pressure had been lowered down practically to that exerted by the mercury at the mouth of the tuyere, that is 4 pounds per square inch. The experiment was repeated several times by different sets of observers, and with different depths of mercury. The result was invariably the same, namely that the mercury did not run back through the tuyere until the air pressure equaled the static pressure of the liquid. It is therefore apparent that with openings as offered by the standard tuyeres (½ to ⅝ in.) the high blast pressures now in use are unnecessary as far as preventing the running back of the iron is concerned.

And yet experience teaches us that high blast pressures are necessary for successful converter operation. Some information on the reasons for such necessity can be gained by watching the mercury in the Carnegie Tech. installation while air is being blown through the metal. If the blast pressure is gradually increased, the behavior of the mercury in the tube changes remarkably. With low pressures, say from five to ten pounds per square inch, bubbles of air rise through the liquid, giving it the appearance of a liquid boiling in an open vessel. With 12 to 15 pounds pressure, chunks of mercury fly up 2½ to 3 feet, but they are still compact. As the pressure rises to 18 pounds or thereabouts, the mercury spouts at times to a height of 4 or 5 feet. The liquid is no longer compact, but is in the shape of drops anywhere from ⅛ to ⅝ in. diameter. As the pressure is increased to 22 pounds, the drops become smaller, and at 30 pounds the mercury is so well atomized that at times it appears like a gray mist of fine globules of metal. The spray of drops rises to more than 12 feet. How much more, we do not know, because it leaves our tube. However, very little mercury escapes, because a cloth bag, tied fast to the end of the tube, catches the spray. What little escapes is very finely subdivided and might almost be called mercury vapor. For reasons of health of the observers the pressure of 30 pounds per square inch is not kept on the apparatus very long. Besides, the whole apparatus shakes violently at the high pressures, because practically the whole body of mercury rises and falls intermittently.

It is evident from these tests that higher and higher blast pressures mean finer and finer subdivision of the liquid iron in a conventer. Low blast pressures mean large bubbles of air which escape, before their oxygen has been entirely absorbed by the iron. Blast pressure should be high enough, and the subdivision of air and metal should be carried far

*Prof. Mech. Engrg., Carnegie Inst. of Technology.

enough, until the discharged gases are free from oxygen. Additional subdivision will serve no useful purpose.

Converter practice then had to decide between large quantities of air at low pressure, or smaller quantities of air at high pressure. As we pass from low pressure to higher pressure, subdivision of air and metal becomes finer and finer, but the gain becomes smaller and smaller. Finally a loss appears, because first, blast pressures become excessively high, which fact means useless power consumption, and second, because too much metal is lost through the mouth of the converter. Practice has shown that the practical range extends from about 22 pounds to about 32 pounds per square inch, depending upon the size of the converter.

The results of the Carnegie Tech. tests while made on a small scale, are nevertheless representative, because opening and length of tuyere coincide with those used in practice, and because the ratio of tuyere area to cross sectional area of converter is the same as used in practice, namely approximately three-fourths of one per cent. A slight difference may come in from the fact that the viscosity of molten iron probably differs from that of mercury. Furthermore tuyere length changes in practice, because tuyeres burn down from almost two feet length to less than 10 in. length in six to eight hours. But none of these differences can seriously affect the mechanical effect of air of different pressures upon liquid metal, so that, as before stated, the experiments with the mechanical converter at Carnegie Tech. may well be taken to depict what is going on in the actual metallurgical converter.—*Blast Furnace and Steel Plant.*

NOTES

The engine of an automobile standing in a garage was started as usual for the purpose of warming it preparatory to starting out. The flywheel exploded killing one man almost instantly and fatally injuring another. Parts of the machine were thrown over 60 feet effecting noticeable damage to a box car on a siding.

A process for using compressed air for hardening steel, where only portions of metal require treatment, has been invited by a metallurgist in Germany.

Natural gas to the extent of 628,578,842,000 cu. ft. was used in the industries in the United States in 1915.

Sulphuric acid to the amount of 100 tons is being made daily at the Garfield smelter from the fume. This formerly went to waste through the stack.

The cement gun was used with success and satisfaction for the cement lining 1¾ in. thick applied with an air pressure of 35 lb. gage, to the interiors of five large steel smoke stacks recently built for the Ford Motor Company, Detroit.

I can add to your troubles, I can subtract from your earnings, I can multiply your aches and pains, I can divide your attention, I can take interest from your work and discount your chances for safety.—*Carelcssness.*

In Trinidad a lone sugar factory gave up the ghost some years ago, the machinery was dismantled and some of the plant torn down. The chimney, however, was left and now a tree has grown up inside of the chimney and the inhabitants are greeted with the remarkable spectacle of branches coming through the cracks.

A vast increase in the production of gasoline from natural gas resulted from expansion of the casing head gasoline industry during the last calendar year. During the year 65,364,665 gallons of raw gasoline was extracted, a gain of 22,712,033 gallons, or 53 per cent. over 1914.

Aeroplane metal is the name of an aluminum alloy patented in England. The patent specifications give its composition as follows: Magnesium, 6.5 to 15 per cent.; cadmium, 2.5 to 10 per cent., and aluminum, 91 to 75 per cent.

The making of permanent magnets is a new Sheffield industry as a result of the war. Not only small magnets, such as are used in magnetos, electric meters and ships' compasses, but one of the largest steel firms is busy making large electric magnets for lifting iron and steel material.

The Engineering Association of the South is to discontinue its existence, the members having decided that there is no place for a society that is neither broadly national nor purely local. The Nashville section of the society, with 150 members, will become the Nashville Engineering Association, and other sections may follow this plan of evolving into local societies.

As showing the great difference in surface area between relatively fine and coarse sands and dust, it has been calculated that a pound of sand deficient in the finer fractions contains 129,030,065 particles, having a surface area of 44,378 square feet. A finer sand was found to contain 232,075,324 particles to the pound and had 60,503 square feet of surface, while a pound of dust was found to consist of 192,715,378,500 particles, representing 527,821 square feet.

A large order for "Imperial" electrically-driven air compressors has been placed with the Ingersoll-Rand Co. of New York, by the Chicago headquarters of the Standard Oil Co. It is planned to install these at some 65 of the latter company's supply stations in that locality. Free air at gas stations is a convenience that benefits both car owner and gasoline seller.—*Gas and Oil Power.*

The most successful acid-resisting alloys are those of iron and silicon containing 14 to 15 per cent. of silicon. According to a paper read by Mr. W. C. Carnell before the American Institute of Chemical Engineering, such alloys resist the action of nitric and sulphuric acids of all strengths, and also are proof against atmospheric corrosion. In the acid industry this alloy is much more efficient than stoneware.

Forty-five men enrolled in the 20th annual three-months' mining session at the College of Mines, University of Washington, Seattle. Their ages vary from 21 to 56 years, averaging 32 years. All but ten of the men have had mining experience. They register from all parts of the Pacific Coast, from Arizona to Alaska. Quartz miners are in the majority, but several placer miners are present, also a few coal men.

It would seem the wiser policy to leave the adoption of the metric system optional, as we and our American cousins have done hitherto, till the civilized nations have agreed upon a really correct unit. Anyone who travels in the countries where the metric system is in force knows that in common practice it is not universally adhered to, but that the old measures and weights are still used by the masses. —*The Engineer,* London.

A compressed air tank in the West Salem (Wis.) Motor Co. garage exploded, causing much property damage and the serious injury of several persons. The tank was guaranteed to withstand a pressure of 200 pounds, but is said to have burst at 180. With the high pressures now demanded for charging heavy tires the margin of safety should have been considerably higher than here indicated. There is no suggestion that any safety valve was provided.

Four tunnel workers in the West Side Water Intake Tunnel, Cleveland, O., were awarded hero medals by the Carnegie Hero Fund Commission for bravery in rescue expeditions after the gas explosions in the crib heading of the tunnel on July 24. The tunnel at that time was full of afterdamp and marsh gas, and in two rescue parties ten or twelve men perished by asphyxiation. The four men who received medals went into the tunnel several times while it was in this dangerous condition, and rescued a number of members of the parties overcome in the tunnel.

The velocity with which sound travels through water is more than four times as great as through the air. As long ago as 1827 the sound of a bell under water was transmitted over 21 miles.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

JANUARY 2

1,210,468. MILKING-MACHINE. Samuel B. Harner, near Xenia, Ohio.

1,210 522-3-4-5. VACUUM CLEANING DEVICE. William V. Orr, Cleveland, Ohio.

1,210,538. AIR-GAGE FOR TIRES. Elias B. Rose, Minneapolis, Minn.

1,210,564. PNEUMATIC FEEDER FOR THRESHING-MACHINES OR THE LIKE. Eddie D. Thorp, Dodge City, Kans.

1,210,679. INTERNAL-COMBUSTION METHOD OF FORCING OR COMPRESSING FLUIDS. Pontus Ostenberg, Los Gatos, Cal.

1. The method which consists in forcing liquid into a cushion chamber containing a fixed elastic fluid cushion by means of internal combusion of air and fuel, maintaining liquid in said cushion chamber at an approximately uniform pressure by means of internal combustion of air and fuel, and utilizing the liquid in a continuous stream from said cushion chamber to force or compress fluids by means of a continuous jet or jets of said liquid.

1,210,713. VENT-VALVE FOR TRAIN STOPS. Hiram G. Sedgwick, Mill Valley, Cal.

1,210,730. COMPRESSION AND SUCTION DEVICE. James B. Vernon, Pittsburgh, Pa.

1,210,747. DRILL. Frank R. Williams, Ottumwa, Iowa.

1,211,049. FLUID-OPERATED PERCUSSIVE TOOL. Lewis C. Bayles, Easton, Pa.

1,211,074. REGULATOR FOR FLUID-COMPRESSORS. Emery L. Bulkley, Painted Post, N. Y.

1,211,161. WIND-POWER. Toshihei Jikihara, Uplan, Cal.

1,211,169. ROTARY COMPRESSOR. Charles Edmund Kells, New Orleans, La.

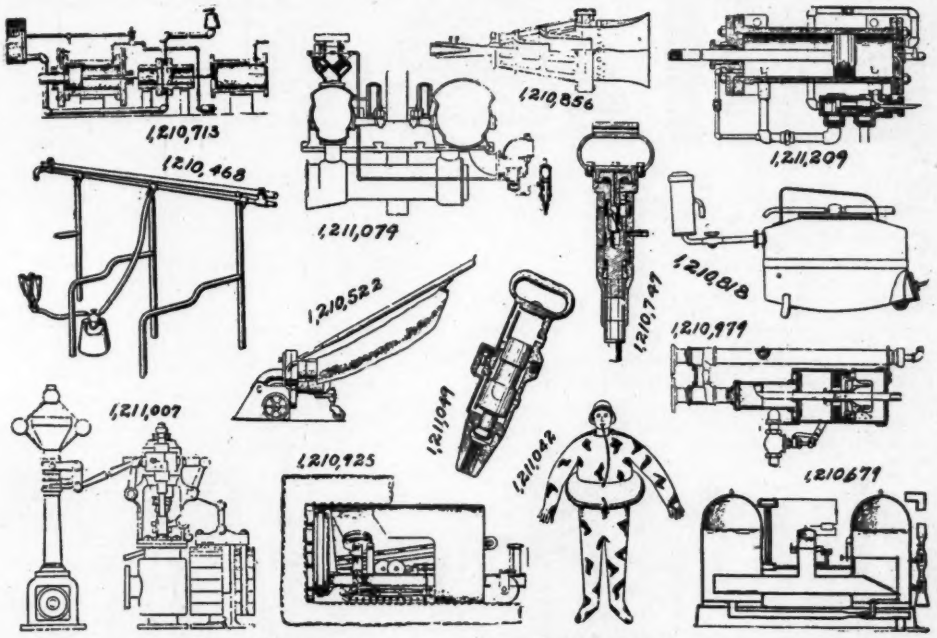
1,211,209. FLUID-PRESSURE MOTOR. Edward W. Meredith, Bloomsburg, Pa.

JANUARY 9

1,211,495. VACUUM GOLD-SEPARATOR. William Shore, Montesano, Wash.

1,211,636. AUXILIARY AIR-SUPPLY FOR INTERNAL-COMBUSTION ENGINES. William B. A. Spray, Vancouver, British Columbia, Canada.

1,211,647. APPARATUS FOR ADMINISTERING ANESTHETICS. Will P. Walter, Chicago, Ill.



PNEUMATIC PATENTS JANUARY 2.

1,210,818. MILK VESSEL FOR MILKING-MACHINES WORKING WITH VACUUM. Knut Ivar Lindstrom, Djursholm, Sweden.

1,210,846. BRAKE MECHANISM. Frederick Henry Royce, Derby, England

1,210,856. HYDROCARBON-BURNER. James E. Sheaffer, Burnham, Pa.

1,210,925. TUNNELING-MACHINE. James C. French, Kenosa, Wis.

1,210,939. RESPIRATING DEVICE. Martin Hilgers, Tazewell county, Ill.

1,210,979. PRESSURE OR VACUUM CONTROLLED TRIPPING MECHANISM. Reginald J. S. Pigott, Bridgeport, Conn.

1,210,981. OIL-BURNER-AIR-SUPPLY REGULATOR. George A. Pingree and Richard A. Uhlin, Seattle, Wash.

1,211,007. GOVERNOR MECHANISM FOR COMPRESSOR-ENGINES AND THE LIKE. Moses Edward Teague, Cinderford, Gloucester, England.

1,211,042. LIFE-SAVING SUIT. Gergely Balogh, Detroit, Mich.

1,211,665. ATOMIZING WATER-SUPPLY MEANS FOR INTERNAL-COMBUSTION ENGINES. Benjamin B. Block, Los Angeles, Cal.

1,211,736. APPARATUS FOR DISINTEGRATING SHAVINGS. David E. Marshall, Kansas City, Mo.

1,211,786. VACUUM-CLEANER. Horace H. Taylor and Leonard A. Moberry, Oakland, Cal.

1,211,846. PNEUMATIC BED FOR HIDE AND LEATHER WORKING MACHINES. Henry A. Holder, Lynn, Mass.

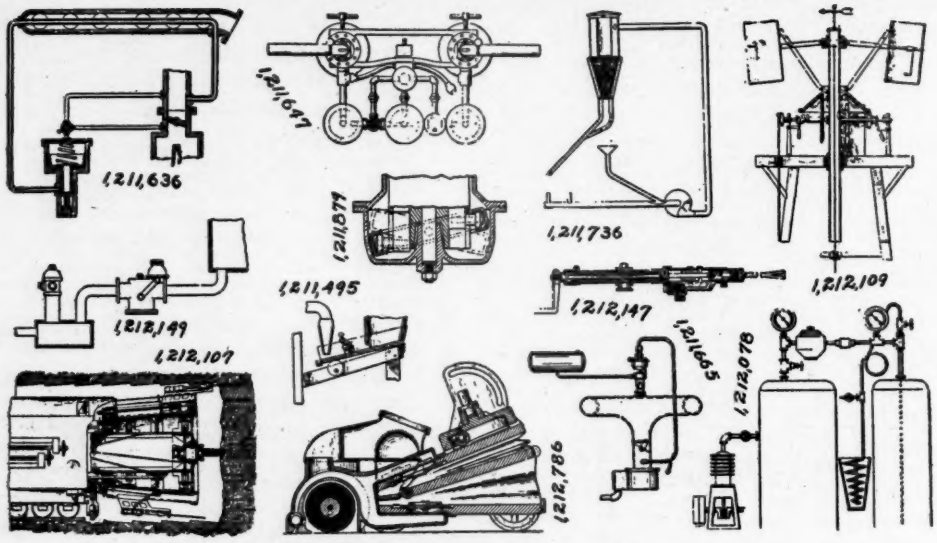
1,211,879. ROTARY PUMP OR BLOWER. James Robertson, Leytonstone, England.

1,212,078. OIL-SUPPLY SYSTEM FOR BURNERS. Henry G. Liebzeit, Shoboygan Falls, Wis.

1,212,107. TUNNELING-MACHINE. Dighton A. Robinson, Seattle, Wash.

1,212,109. WIND-MOTOR. Ernest C. Rodwick, Santa Barbara, Cal.

1,212,141. HAMMER ROCK-DRILL. Walter E. Kimber, Harlesden, London, England.



PNEUMATIC PATENTS JANUARY 9.

1,212,149-50. FLUID-METERING SYSTEM. George Goodell Earl and Albert Baldwin Wood, New Orleans, La.

JANUARY 16

1,212,193. APPARATUS FOR REMOVING SUSPENDED MATTER FROM GASEOUS FLUIDS. Henry L. Doherty, New York, N. Y.

1,212,393. PNEUMATIC CONCENTRATING-TABLE. Clarence Q. Payne, New York, N. Y.

1,212,455. SEPARATION OF THE CONSTITUENTS OF GASEOUS MIXTURES. Georges Claude, Paris, France.

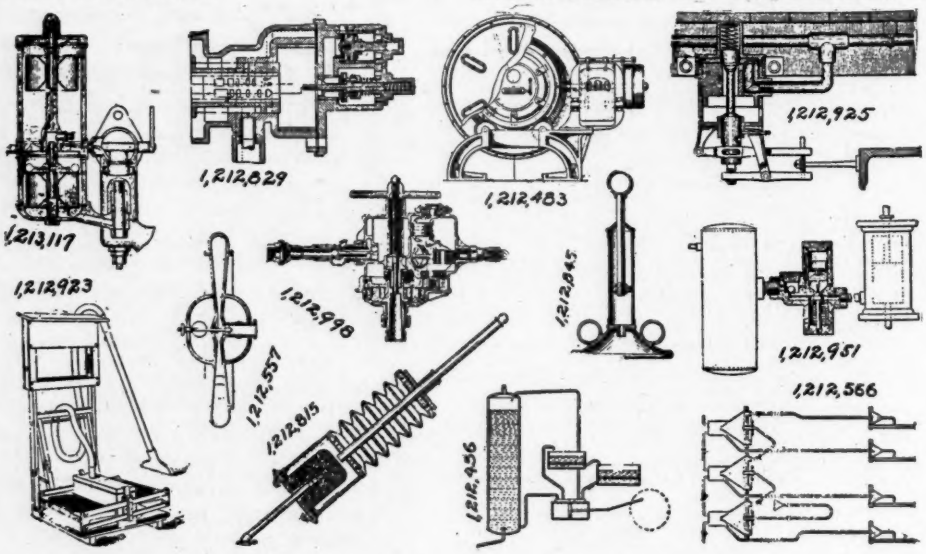
1,212,456. PURIFICATION OF GASES. Georges Claude, Paris, France.

1,212,483. VACUUM-CHURN. Ernest B. Heller, New York, N. Y.

1,212,557. APPARATUS FOR MIXING AND CONVEYING FLUIDS. Jean Alexandre Rey, Paris, France.

1,212,566. SEPARATING FINELY-DIVIDED ORE MIXTURES IN VACUUM SEPARATING VESSELS OR CHAMBERS. Friedrich Arthur Maximilian Schiechel, Frankfort-on-the-Main, Germany.

1. The Process of separating ore pulp, which includes subjecting a collection of such pulp to a vacuum sufficient to remove part of the metallic particles, and then subjecting the



PNEUMATIC PATENTS JANUARY 16.

collection to another and higher vacuum to remove metallic particles remaining after the first removal.

1,212,815. DOMESTIC CLEANING APPLIANCE. Carl Herrmann Roth, Southport, England.

1,212,829. AIR-BRAKE-CONTROL VALVE. Jacob Rush Snyder, Pittsburgh, Pa.

1,212,845. MASSAGE APPARATUS. Edwin R. Talley, Grinnell, Iowa.

1,212,923. PUMPING MECHANISM FOR VACUUM-CLEANERS. Andrew J. Faucher, Wichita, Kans.

1,212,925. AIR-PROOF COMPOSITION. Walter O. Fleckner, Cloverdale, Cal.

1. The hereindescribed process of producing a plastic composition for forming an air and liquid tight joint or connection which consists in cooking together resin and tallow until the ingredients are well melted, allowing the mixture to cool and then beating the mixture until it assumes a white color.

1,212,945. VACUUM SERUM-EXTRACTOR. Thomas P. Haslam, Manhattan, Kans.

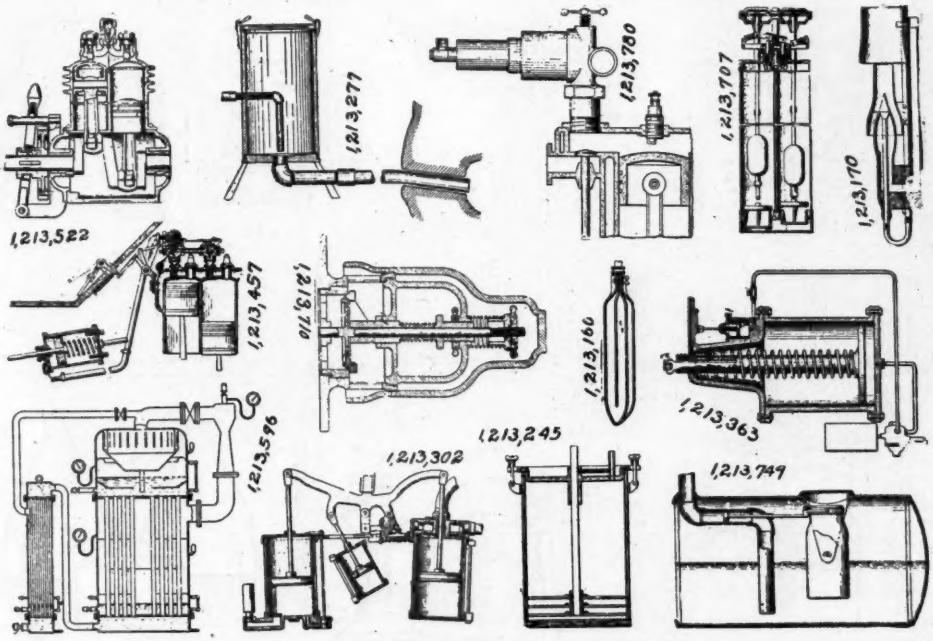
pipe and having a flaring unobstructed inlet end submerged in the body of water, a nozzle located below said foot-piece and arranged to discharge air under pressure into said foot piece and means to supply compressed air to said nozzle.

1,213,245. CEREAL-MACHINE. David C. Parks, near Kimmswick, Mo.

1. A machine for reducing cereals to a meal like form, comprising a closed hollow cylindrical container having a central bearing in its top, a shaft mounted in said bearing and adapted to reciprocate therein, a series of cutting knives carried at the lower end of said shaft, and means for admitting compressed air to the interior of said container.

1,213,277. POWDER-LOADING DEVICE. William T. Scott, San Diego county, Cal.

1. In a device for loading explosive powder the combination of a powder receptacle provided with an aperture therein, an air inlet pipe adapted to connect with a compressed air tank and extending inwardly through the wall of said receptacle, its extended end ex-



PNEUMATIC PATENTS JANUARY 23.

1,212,951. RELIEF-VALVE FOR COMPRESSOR SYSTEMS. Arthur O. Higinbotham, Worcester, Mass.

1,212,955. SAFETY AIR-BRAKE VALVE. William S. Ingram, Raleigh, N. C.

1,212,975. ELASTIC-FLUID TURBINE. John A. MacMurchy, Wilkinsburg, Pa.

1,212,998. FLUID-MOTOR DRILL. Caid H. Peck, Athens, Pa.

1,213,117. VACUUM FEED DEVICE. Oscar L. Loughead, Racine, Wis.

JANUARY 23

1,213,160. BREATHING-BAG. Robert Henry Davis, London, England.

1,213 170. METHOD AND APPARATUS FOR LIFTING WATER. Levi T. Edwards, Philadelphia, Pa.

1. In an apparatus for lifting water, the combination of a well, a delivery pipe extending into said well, a foot piece secured to said tending to near said aperture in said receptacle and adapted to be moved to different positions relatively to said aperture for adjustment for different sized grains of powder and means for conducting the powder from said aperture to the pocket in which it is to be deposited.

1,213,302. APPARATUS FOR PRODUCING ARTIFICIAL RESPIRATION. William E. Tullar, Chicago, Ill.

1,213,342. MILK AERATOR. Michael Duvall, Marshfield, Wis.

1,213,363. AIR-BRAKE ATTACHMENT. Murray Henry, Alexandria, La.

1,213,457. PNEUMATIC BRAKE FOR AUTOMOBILES. Conway F. Candler, Orange, Cal.

1,213,522. AIR-PUMP. Charles W. Manzel, Buffalo, N. Y.

1,213,523. SHOCK-ABSORBER. Richard Martin, Alameda, Cal.

1,213,596. EVAPORATOR. William L. De Baufre, Annapolis, Md.

1. An evaporator consisting of, means of containing a solution, means of compressing the vapor from said solution consisting of a vapor actuated compressor, means of heating said solution by said compressed vapor and the exhaust from said compressor and means of drying said vapor before being compressed.

1,213,701. VACUUM MASSAGE DEVICE. Alvin L. Smith, Washington, D. C.

1,213,707. PNEUMATIC PUMP. John M. Swanstrom, Chicago, Ill.

1. In a device for raising water by compressed air, a water chamber having an air inlet opening in its upper end, a valve adapted to close the air inlet opening against the air supply pressure, means operated by the air pressure within the water chamber for causing the valve to close the air inlet opening against the air supply pressure, and means independent of the valve closing means for holding the valve in closed position.

1,213,889. TURBINE PUMP OR COMPRESSOR. Franz Lawaczeck, Halle-on-the-Saale, Germany.

1,213,901. ASPIRATOR. Elbert Ball Porter, Penn Yan, N. Y.

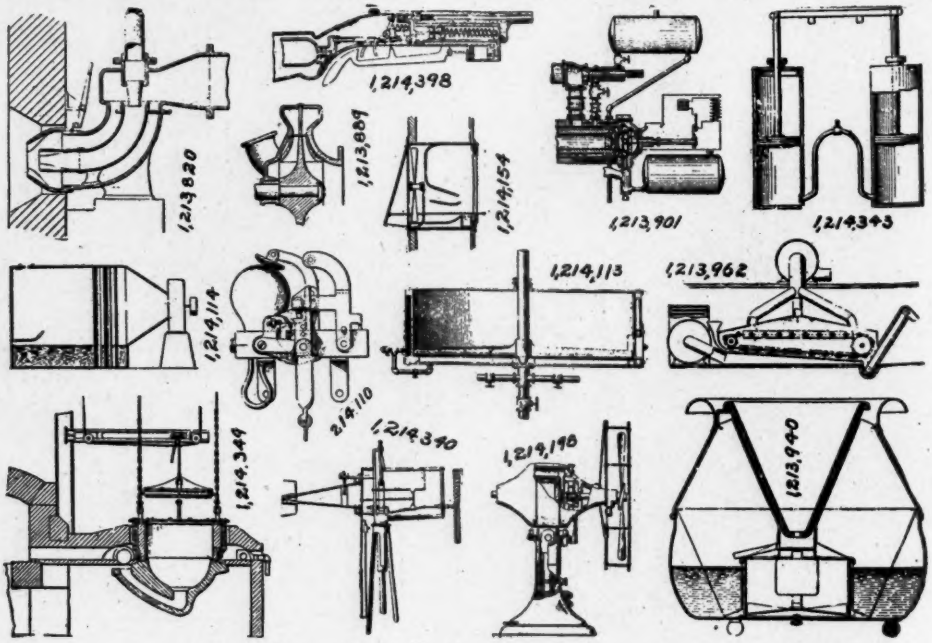
1,213,940. HUMIDIFIER. Lee H. Parker, Brookline, and Edward K. Standish, Stoughton, Mass.

1,213,962. DRYING APPARATUS. Earnest E. Siler, Chicago, Ill.

1,214,055. WELDING AND SOLDERING TORCH. Adolf Messer, Frankfort-on-the-Main, Germany.

1,214,110. MUSIC-LEAF TURNER. John B. Albert, Danbury, Conn.

1. In a leaf turner, a support, a swingingly mounted hollow leaf carrier, a self-expansible collapsible body communicatively connected with the carrier for creating a vacuum therein whereby a leaf will adhere to the carrier, and means operable in one continuous direction for effecting both a collapsing and releasing of the body.



PNEUMATIC PATENTS JANUARY 30.

1,213,710. COMBINED PRESSURE AND VACUUM RELIEF VALVE. Frederick Mortimer Timpson, Ilford, and Alexander Ogilive Robertson, London, England.

1,213,749. FIRE-EXTINGUISHER SYSTEM. Robert L. Cooney, Atlanta, Ga.

1,213,780. APPARATUS FOR COMPRESSING AIR. Stephen G. Skinner, Wilmette, Ill.

1,213,782. AIR-COOLING DEVICE. Willis H. Thomas, Portland, Oreg.

1,213,791. FLUID-PRESSURE ENGINE. James Nicolson Bailey, Stretford, England.

1,213,796. PROCESS OF COMPRESSING, PURIFYING, DRYING, AND COOLING GASES. Willard Oliver Felt, Bradford, Pa.

JANUARY 30

1,213,815. CONTROL SYSTEM FOR RAILWAY AIR-COMPRESSORS. Clinton J. Axtell, Schenectady, N. Y.

1,213,820-1-2. PULVERIZED-FUEL BURNER. Lars H. Bergman, Philadelphia, Pa.

1,214,113. TANK FOR TREATING GARBAGE. James A. Anderson, Barren Island, N. Y.

1,214,114. APPARATUS FOR CONDITIONING AIR OR OTHER GAS. Bernard R. Andrews, Newton, Mass.

1,214,154. VENTILATOR AND AIR-PURIFYING APPARATUS. Frank A. Gustavason, Seekonk, Mass.

1,214,198-9. ELECTRIC FAN. Willard M. McEwen, Chicago, Ill.

1,214,268. AIR-BAG FOR MENDING PNEUMATIC TIRES. John W. Blodgett, Chicago, Ill.

1,214,340. WINDMILL. Benjamin J. MacEwen, Canutillo, Tex.

1,214,343. SHOCK-ABSORBER. John W. Matthews, Macon, Mo.

1,214,349. WINDOW-GLASS-BLOWING APPARATUS. Tony A. Miller, Morgantown, W. Va.

1,214,398. AIR-GUN. Herman L. Welch, Los Angeles, Cal.